JANUARY 1959

POWER INDUSTRY

PLANT & POWER SERVICES

In this issue — over 40 reports of technical developments in plant and power services

PLAN AHEAD ON A POWER SERVICE SYSTEM . . . page 16

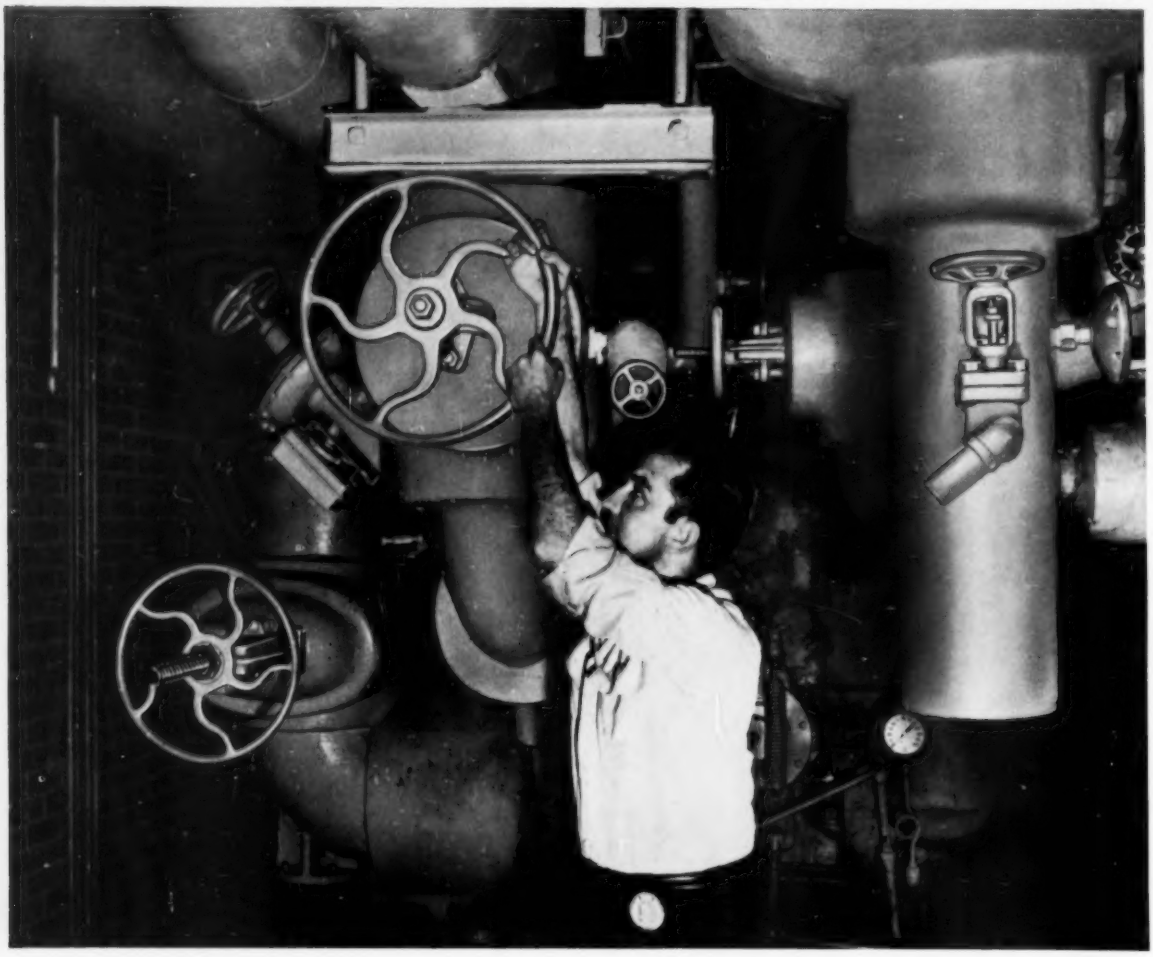
'We Are Being *MISLED* on Nuclear Power'

DR. ROBERT E. WILSON
Former Chairman of Board
Standard Oil Company (Indiana)

A PUTMAN PUBLICATION
"Executive Magazines for Industry"

University Microfilms
313 N First St
Ann Arbor Mich
Exchange list 1-50 I

Cities Service shows how to cut valve costs



Crane globe valve in 14th year on steam turbine line

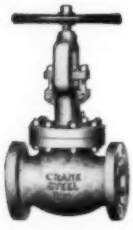
Cities Service Refining Corp. uses hundreds of valves at its Lake Charles, La., plant. Maintenance and replacement costs could be staggering, but for careful control of valve selection.

For example, the Crane 6-inch, 300-pound steel globe valve shown above was installed at the Lake Charles plant 14 years ago. Working at 250 psi., 600 deg. F., the valve is used in the steam line to a turbine-driven feed-water pump.

In spite of its operation 3 or 4 times a week, this sturdy Crane valve has continued tight in service and has required no repairs in 14 years!

Thrifty buyers want no better reward than the kind of cost-cutting, dependable service they get when Crane valves are installed.

That's why in the petroleum industry, as in all industries, you'll find more Crane valves used than any other make.



This is the valve used on installation above. CRANE 151XR, 300-pound cast steel globe valve for 850° F. maximum temp. Sizes: 2 in. to 8 in. For full details, see your Crane Representative, or write to address below.

CRANE VALVES & FITTINGS

PIPE • PLUMBING • KITCHENS • HEATING • AIR CONDITIONING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

Circle 9352 opposite covers.

Jan. 25-29: AED 40th Annua Meeting; Conrad Hilton Hote Chicago, Ill.

Jan. 26-29: ASHAE 65th Annua Meeting; Commercial Museum Philadelphia, Pa.

Jan. 26-29: Plant Maintenance Engineering Show; Public Au ditorium, Cleveland, Ohio.

Jan. 26-29: 14th Internationa Heating & Air Conditionin Exposition; Convention Hal Philadelphia, Pa.

Feb. 3-5: 14th Reinforced Plastic Conference; Edgewater Beac Hotel, Chicago, Ill.

Feb. 12-13: 1959 Solid State Ci cuits Conference; Philadelphia Pa.

Feb. 16-19: Industrial Ventilatio Conference; Kellogg Center fo Continuing Education, Michi gan State University, East Lan sing, Mich.

Mar. 16-20: National Associatio of Corrosion Engineers, Natio al Meeting; Sherman Hote Chicago, Ill.

Mar. 31-Apr. 1-2: 21st America Power Conference; Hotel She man, Chicago, Ill.

Apr. 5-9: Edison Electric Institut Annual Convention; New O leans, La.

Apr. 6-10: 1959 Welding Show 40th Annual Convention; Hote Sherman and Internationa Amphitheatre, Chicago, Ill.

Apr. 13-17: The Engineered Cas ings Show; Sherman and Mo rison Hotels, Chicago, Ill.

Apr. 22-24: 3rd Annual Technica Meeting and Equipment Sho of IEE; LaSalle Hotel, Chicag Ill.

Apr. 29-May 4: Oil-Heat Institut of America, Inc.; Seattle, Was

May 5-6: Interdisciplinary Co ference on Self-Organizin Systems; Museum of Scienc and Industry, Chicago, Ill.

May 5-7: 14th Purdue Industria Waste Conference; Purdue Me morial Union Building, Lafay ette, Ind.

May 6-8: IRE Seventh Region Conference and Trade Sho University of New Mexico, A buquerque, N. M.

POWER INDUSTRY

. . . with which are combined INDUSTRIAL POWER and INDUSTRY POWER . . . serves the key men responsible for plant and power services throughout all industry, including utilities, and also in complexes of public institutions, schools, hospitals, etc.

The function of these plant and power services is to create and maintain the environment and provide the facilities necessary to effective operation of these industries and/or buildings, regardless of variety of products manufactured or uses of buildings.

The plant services include lighting, heating, ventilating, refrigeration, water supply and treatment and other conditions and material services needed for directed activity.

The power services include production, transmission and application of all forms of energy — steam, electric, mechanical, pneumatic, hydraulic, atomic — and the engineering and maintenance necessary for its continuance in:

- **MANUFACTURING AND INDUSTRY**
  - Chemical and process industries
  - Electrical and industrial machinery
  - Food and kindred products
  - Central utility stations and engineering headquarters
  - Textile manufacture
  - Gas companies and pipelines
  - Lumber and wood products
  - Waterworks
  - Metal industries
  - Stone, clay and glass products
  - Atomic energy
  - Transportation equipment
- **PUBLIC SERVICES AND INSTITUTIONS**
  - Hospitals
  - Office buildings
  - Hotels
  - Schools and colleges
  - Marine
- **CONSULTANTS**
  - Consulting engineers
  - Industrial architects
  - Contractors

Published monthly by

PUTMAN PUBLISHING COMPANY

PUTMAN PUBLISHING BUILDING
111 E. Delaware Place, Chicago 11, Illinois
WHitehall 4-6141

Also publishers of
CHEMICAL PROCESSING, FOOD PROCESSING, FOOD BUSINESS

ADMINISTRATION

Russell L. Putman	President & Publisher
Ewing W. Graham	Vice President & Treasurer
Richard H. Putman	Sales Manager
Roy G. Helsing	Production Manager
James C. Budd	Asst. Production Manager
George W. N. Riddle	Director of Research & Development
Thomas J. Scanlon	Director of Circulation
Robert C. McKay	Circulation Manager

Advertising Representation is listed on page 34

SUBSCRIPTIONS

QUALIFIED READER SUBSCRIPTIONS are accepted without charge from selected executives and engineers who manage plant and power services in plants and organizations. Subscriptions are accepted from "non-qualified" people—i.e., those whose job responsibilities are not within the orbit of management as described above—at $1.00 the copy; $10.00 the year in U.S.; $15.00 outside U.S. Note: Such subscriptions are available only as an accommodation and in response to specific request. They are not counted as "industry circulation" on BPA Audit Reports. Accepted as controlled circulation publication at Mendota, Ill., 1501 W. Washington Rd.

BPA BUSINESS PUBLICATIONS AUDIT of Circulation, Inc.

NBP NATIONAL BUSINESS PUBLICATIONS, INC.

January 1959

VOL. 75 No. 1

POWER PLANT & POWER SERVICES INDUSTRY

© 1959, Putman Publishing Co.

PUTMAN PUBLISHING COMPANY • 111 EAST DELAWARE PLACE • CHICAGO 11, ILLINOIS

IN THIS ISSUE

11 **How to handle steam trap maintenance**

Eastman Kodak has some 60,000 steam traps at its Kodak Park and many have to be serviced in totally dark areas. Engineer Richard Kondolf tells how a well organized program handles this major maintenance problem

12 **Meeting wide turbine load demands**

Intricate control system for turbo-generator installation at Thurso Pulp & Paper Co. has been designed to meet unusual steam and power demands

14 **We are being misled on nuclear power**

Dr. Robert E. Wilson paints a vivid picture of the nuclear power situation, separating fact from fiction

16 **Plan ahead on power service system**

Reading Tube Corp. looked far into the future and came up with a power system that will easily take care of expansion when it comes

22 **Analyzes boiler water automatically**

MONTHLY FEATURES

2 Conventions & Exhibits
4 Reports in Brief
10 Letters
20 New Developments
26 New Literature
27 Engineering Data
33 Photo News

EDITORIAL STAFF

editorial director & publisher
Russell L. Putman

editor
H. A. Countryman

managing editor
George V. Michael

west coast editor
Karl Robe

advisory editor
John W. Bishop

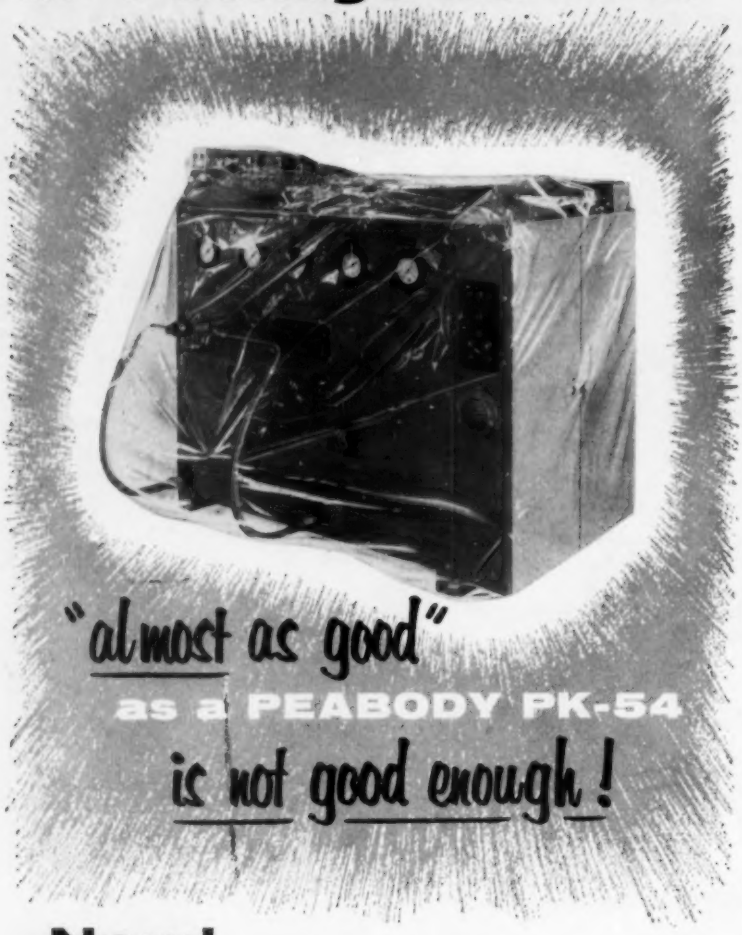
advisory editor
Richard F. O'Mara

editorial assistants
Erin Tomcheff
Joann Schmitt

Special Service for Readers

Want more information? Circle the key number of ad or editorial on the postpaid cards opposite covers of this issue.

In "Package Burners"



Now!

Completely Re-designed...

. . . to bring *you* the most advanced components of the Quick-Detachable type...pioneered and field-tested by Peabody and available *only* in the new PK-54 burner.

The plug-in combustion control modulating system, the plug-in combustion safeguard and sequence system and all valve assemblies, installed with steel tubing and flared fittings, are quickly and easily replaced in the field as complete units.

These components insure optimum performance, ruggedness, durability and above all, maximum facility for testing or maintenance.

Write today for new bulletin 430-B.

PEABODY ENGINEERING CORPORATION
232 MADISON AVENUE, NEW YORK 16, N.Y.
OFFICES IN PRINCIPAL CITIES
PEABODY LIMITED • LONDON, S.W. 1, ENGLAND

B-360

Circle 9353 opposite covers.

Putting a new boiler on line? Here's how to clean it out

Prior to placing a new boiler on line, it should be boiled out to remove oil and grease present on metal surfaces. Where this oil contaminates the feed-water, it is necessary to remove the oil, as it will carryover and leave sticky deposits on clean surfaces.

A specially formulated material provides detergent, emulsifying and dispersive action on greases and oil normally found in new boilers or in operating boilers. It is supplied in form of quickly soluble, one-pound briquettes.

Using these briquettes, the boiling out procedure is as follows: First, the high-pressure gage glasses should be replaced with temporary glasses to prevent attack on the glass by various detergents in the boil-out mixture.

Required number of briquettes can simply be placed in boiler drum or divided equally between drums of multidrum boiler. Seven briquettes are used for each 1000 pounds of water contained in the boiler.

After addition of the briquettes, all manholes should be closed and boiler filled to top of gage glass with vents open. It should be fired at a low rate in accordance with the manufacturer's recommendation.

When water reaches temperature of 212°F and steam is flowing freely from vents, close all vents except those specified by manufacturer on boilers containing superheaters, where superheater protection is required.

Raise pressure to minimum of 25 psi and maintain this pressure for approximately 48 hours. (For higher-pressure boilers it is usual to boil out at ½ operating pressure to assure circulation.) In all cases, the manufacturer's recommendations on boil-out pressure should be followed.

Boiler then should be blown down ½ a gage glass approximately every eight hours through bottom blow-off valve. Should there be more than one blow-off connection use alternate valves. After blow-down, boiler should be refilled to top of glass.

The fire should then be put out, and boiler allowed to cool gradually. When cool, open all drain and blow-down valves and drain boiler completely.

All parts should be washed thoroughly with a high-pressure hose, and after this washing, a thorough internal inspection should be made. If any scum or oil remains, procedure should be repeated.

The briquettes are specially formulated to provide most effective removal of oil and greases. Experience has shown that use of inorganic agents alone is relatively ineffective.

However, if circumstances require use of readily available materials, the following inorganic formulation is recommended: Three pounds caustic soda, three pounds anhydrous disodium phosphate and one pound of sodium nitrate for each 1000 pounds of water.

These chemicals should first be dissolved in water and then solution added to boiler before filling.

(For more information on boil-out procedure, contact Betz Laboratories, Inc., Dept. PI, Philadelphia 24, Pa.)
Circle 9354 opposite covers.

Develop lamp whose light approaches sunlight

Combining in one compact, long-lasting unit the best features of incandescent, fluorescent, and mercury vapor lighting, a lamp has been developed which produces brilliant light described as "ap-

proximating natural sunlight."

The lamp, called Fluomeric and developed by Duro-Test Corp., has a life of 6000 to 12,000 hours. It screws into an ordinary electric socket, requires no auxilary equipment, and obtains full brilliance almost immediately.

To produce its full-spectrum light, it combines three light elements in this way: The pure tungsten incandescent filament provides predominantly orange light, the mercury vapor arc discharge tube supplies blue and green, and the fluorescent phosphors add the deep red factor.

Because of its long life, the lamp will be a boon in industrial installations where lamps are located in high bay areas on poles or in other hard-to-reach places where replacement is difficult and sometimes hazardous.

Studies use of aluminum for strip winding

A project to introduce aluminum strip winding to electrical coils has been announced by Alcoa.

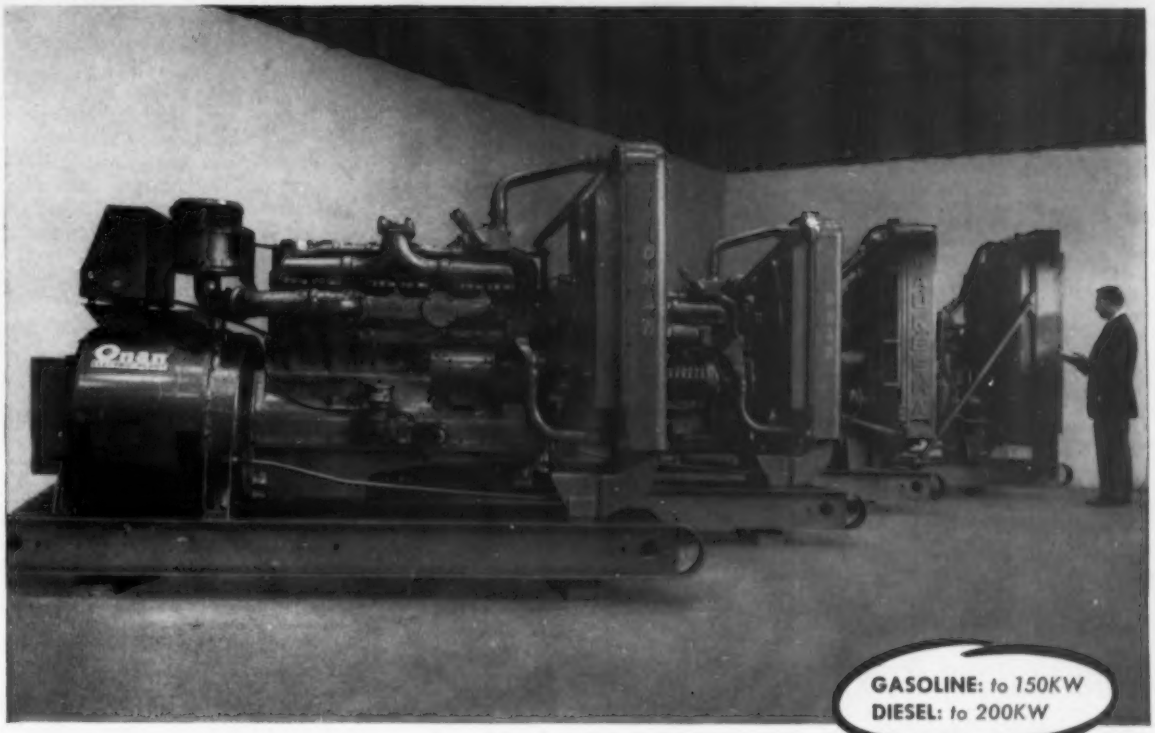
Key activity in the project involves "tailor-making" coils wound with aluminum sheet or foil. Studies have indicated significant economic advantages in designing aluminum strip windings for coils that would use wire of No. 24 AWG size, and larger.

One element involves replacement of wire windings with strip windings in relatively large coils, using conventional insulating and spacing materials.

Alcoa has also investigated a broad range of alternatives to conventional insulation, interweaving, and spacing materials.

Specification coil winding activities involve coils ranging in size from small solenoids up to 50-kva coils for power transformers. Performance of strip-wound coils of larger size can be determined from the studies of the 50-kva size.

Now...Onan Electric Plants to 200KW!



New Magneciter Generator leads "break through" to new high in electric plant performance*

Now you can have Onan engineering and Onan dependability in high-capacity plants, too! The leader for years in the design and production of small and medium-sized plants, Onan offers models to 200KW, built to Onan's high standards of performance.

In gasoline-powered models, 100, 125, and 150KW sizes have been added to the line. New diesel models start with 10KW and include 15, 25, 35, 50, 60, 75, 100, 125, 150, 175, and 200KW capacities. All standard voltages are available.

All models are powered by heavy-duty industrial engines carefully matched to the power requirements of the generator.

Custom modifications to meet the needs of particular applications add to the versatility of the new Onan line. Automatic controls for standby installations are available for each model.

All plants of 100KW and larger are equipped with the new Onan Magneciter. This new generator with static exciter and voltage regulator provides outstanding performance advantages for both standby and primary power installations.

*Onan alternator with static excitation and static voltage regulation through saturable reactors with magnetic amplifiers.

Here are the advantages of the Onan Magneciter Generator

- **Simplicity**—Eliminates hundreds of electrical connections, commutator and its brush rig.
- **Constant voltage**—Voltage dip is less than 20% with motor starting load. Stable generator operating conditions re-established within 2 seconds after load is applied.
- **Lighter weight, more compact**—Plants are shorter by a foot or more, lighter in weight.
- **Less maintenance, easier servicing**—The static exciter and regulator are externally mounted and easily accessible.

Onan builds Electric Plants from 500 watts to 150KW A.C., gasoline-powered; 3,000 watts to 200KW A.C., Diesel-powered. Portable, primary, and standby models. D.C. battery chargers and separate generators also available.

Specification kit available now! Write for it!

D. W. ONAN & SONS INC.

3323 UNIVERSITY AVE. S. E., MINNEAPOLIS 14, MINNESOTA

Onan ELECTRIC PLANTS

Circle 9355 opposite covers.

Completely New Concept from SCHAUB
In one package you get complete instrumentation, automatic after-cooling and sample cooling, automatic timed pressure flush to maintain high recovery efficiency, individual volume control valves, (with illuminated sight flow indicators), heat exchanger and flash tank. Matching cabinet sink is final touch. All interconnecting piping and wiring are installed. Only service connections need be made.

Ready-to-install Packaged Console for Continuous Boiler Blowdown and Recovery Handles all Functions Automatically

Saves Engineering Time, Saves Installation Time; Gives Maximum Thermal Recovery. It Does Not Forget, Mis-time, "Overshoot" or "Undershoot"

Schaub's continuous boiler blowdown and sampling system helps produce significant boiler room savings. With each operation performed exactly as it should be, when it should be, with no water lost in overflushing or overcooling, reduced costs can be anticipated. Thermal recovery is constant and at a high level. Mantime requirements are less. Space requirements are reduced. This Schaub Automatic Console System needs only field service connections to put it into full operation. Several man-weeks of design time, plumbing, steam fitting and wiring are eliminated.

For those boiler rooms where the fully automatic operation, complete instrumentation and cabinet design of the Schaub Console system may not be desired, Schaub can provide a ready-to-install "basic" system which provides all the functions of continuous blowdown, but under manual control.

Two, three or four boilers can be handled; either 250 pound or 600 pounds WSP. Capacities to 6000 lbs./hr. total blowdown. To learn further details on Schaub Systems for continuous Boiler Blowdown, mail the coupon below.

FRED H. SCHAUB ENGINEERING COMPANY
2115 S. Marshall Blvd., Chicago 23, Illinois

Please send me, without cost or obligation, my personal copy of your Bulletin 8001 on Continuous Boiler Blowdown.

FRED H. SCHAUB ENGINEERING COMPANY
2115 South Marshall Blvd., Chicago 23, Ill.

Name.....
Company.....
Address.....
City.....Zone....State.....

Circle 9356 opposite covers.

Another way to get high vacuums

Because it would require pumps and fans filling almost an entire city block, a hypersonic wind tunnel at the University of Southern California creates its wind with a rather unconventional technique.

A high vacuum, created by refrigeration at one end of the tunnel sucks nitrogen gas from the other end of the chamber over objects being tested.

Nitrogen is being used instead of air because moisture does not have to be removed from the gas.

The refrigeration system uses a method known as "cryopumping." Cryopumping produces such a low temperature that all of the gas in the chamber freezes to a solid leaving a high vacuum.

In this case a helium refrigeration system is used. Principle can be used to create high vacuums for other purposes.

Some startling figures about the installation — only moving parts are in refrigerator, which runs on a 50-hp motor. A comparable unit based on a gas-diffusion pump, would require 500,000 hp.

Arthur D. Little, Inc. designed the refrigeration system.

Hot TV

A closed-circuit television system capable of providing a clear picture in temperatures exceeding 2000°F has been marketed by General Electric Co.

The system utilizes an air-cooled lens that allows remote viewing of boiler flames or "hot" areas without danger of the lens melting.

Lens is housed in a 14-inch steel tube. Compressed air is blown through peep holes in the lens housing and across face of lens.

Requiring only 15 cfm of air for cooling, the system was designed primarily for large industries and utilities. Lens angle view is better than 40°. Lenses are interchangeable.

Saves $$$ on cleaning electric motors

Cost of cleaning large electric motors have been reduced as much as 75% through on-site use of nonflammable non-explosive "Freon" solvents in tests conducted by the Du Pont Company.

In addition to cost and safety advantages, these solvents will not attack insulating materials and varnishes used on motor windings. The fact that they permit in-place cleaning rather than dismantling of motor for cleaning in the shop reduces equipment down-time and makes practical a continuing program of preventive maintenance.

No Dismantling

For example, at one of the Du Pont's plants, an enclosed 600-hp motor was cleaned in one day, without dismantling at solvent cost of about $80. Previously, cleaning the same motor cost nearly $400, including dismantling for shipment to an off-plant cleaning and service site.

Procedure for cleaning the motor with "Freon" solvent was as follows: End bells and coil shields were removed from motor to permit access to armature coil and stator area.

Solvent Removes Dirt

Solvent was then sprayed on coating of oil, grease, and dirt that had accumulated on coil and stator surfaces. Most of softened accumulation was brushed off with small paint brush.

Final cleaning was accomplished by high-velocity power-spraying of solvent over coil and stator and removing solvent-dirt mixture from bottom of motor housing.

A faster method could be used on motors where housing permits introduction of liquid solvent into a liquid-tight housing around bottom of motor. In this way the motor could be turned over in liquid bath. After draining out solvent-soil mixture, motor should be ready for use within a few hours.

Aluminum transformers inside . . .

What is to be the largest power transformer ever built with electrical and structural parts made of aluminum has been manufactured by General Electric.

The power transformer uses aluminum foil in its winding structure and aluminum core clamps, tank, and cooling radiators.

Magnetic and insulating parts of the 20,000-kva unit are conventional — i.e., grain-oriented silicon steel, various kinds of turn and winding insulation, and transil oil for cooling and insulating whole internal assembly.

Use of aluminum foil accounts for better transient voltage characteristics, reduced space factor, and lower heat loss.

These — rather than weight reductions — are chief advantages, although aluminum in tank and structural parts reduce overall weight.

. . . and outside

On distribution transformers of 25-kva and larger sizes, an aluminum housing can be easily manufactured from extrusions.

According to Reynolds Metals Company, the extruded sections will have ready-made fins for dissipating heat. In addition, the extrusions incorporate lifting lugs, hanger attachments, and core and coil supports.

The lighter weight afforded by the aluminum tank will make installation of the transformers easier, safer and more economical.

Welding society opens information center

As a service to industry, an Information Center has been established by the American Welding Society, 33 West 39th St., New York.

Center will disseminate welding news and information, acting as an authoritative source for all information related to welding.

INDUSTRY

served by UNITED ELECTRIC COALS

More than 85% of United Electric Coal is produced for basic industries and electric power utilities in the middle west. United Electric has the resources to meet the special needs of users of large tonnages of coal. Huge production operations. Modern preparation plants. Flexibility in distribution with both rail shipments and low-cost, all water transportation on the inland waterways. An efficient service organization. Dependable deliveries to meet all normal and emergency requirements of users.

BUFFALO CREEK	FIDELITY	CUBA-BUCKHEART	MARY MOORE	RUBY
washed West Kentucky No. 6 industrial and domestic stoker coal	*domestic and industrial stoker coal*	*precision prepared coals*	*No. 7 Illinois for industrial and utility use*	*washed West Kentucky No. 11 for industrial and domestic use*

ruby

THE UNITED ELECTRIC COAL COMPANIES

CHICAGO, 307 N. Michigan Ave., Phone CEntral 6-6580 • PEORIA, Commercial National Bank Building, Phone 3-3711 • ST. LOUIS, Ambassador Building, Phone GArfield 1-3732

Circle 9357 opposite covers.

new answers to these DIESEL PROBLEMS

EXHAUST VIBRATION
PIPE EXPANSION
FLANGE MISALIGNMENT
ENGINE PULSATIONS
OFFSET MOTION
OIL LINES
AIR INTAKE

IN ALLIED'S NEW DIESEL DATA BROCHURE 10-X-552

This new fact-filled brochure gives latest Engineering Data on **corrugated steel** and **stainless steel Diesel exhaust** and **air intake lines** . . . installation diagrams and tables plus analyses of Diesel engine pipeline problems . . . how Allied's 10-X and 21-X overcome vibration, expansion and contraction, misalignment, engine pulsations, offset.

WRITE, WIRE, PHONE FOR YOUR COPY TODAY!

ALLIED METAL HOSE CO.
3791 Ninth Street, Long Island City 1, N. Y., STillwell 4-5173

Circle 9358 opposite covers.

A FAITHFUL GUARDIAN THAT NEVER SLEEPS

HENSZEY BOILER FEED REGULATOR
Set it . . . Forget it

Rest assured . . . you can always depend on this rugged Henszey Regulator. It automatically guards boiler levels night and day with untiring vigilance. Its Spartan simplicity and lasting strength insure constant, "care-free" operation. Nothing to get out of order . . . dependable. This compact unit installs right on the line without additional supports. Made for pressures up to 600 lbs. in sizes up to 4 in. For information, write:

HENSZEY COMPANY
DEPT. A • WATERTOWN, WISCONSIN

HENSZEY

Representatives from Coast to Coast

HENSZEY BOILER FEED REGULATORS
Continuous Blowdown • Distillation Systems • Heat Exchangers • Feed Water Meters
Flow Indicators • Proportioning Valves • Also MILK EVAPORATORS and PRE-HEATERS

Circle 9359 opposite covers.

New twist to old idea gets power from gas transmission

Using a principle as old as the water wheel, a new source of power has been found for the natural gas industry.

Converting otherwise wasted energy into useful work, the development utilizes flow of natural gas in a transmission line to power a type of steam engine.

Development is result of cooperative work by La Gloria Oil & Gas Company, Houston, Texas, and Troy Engine & Machine Co., Troy, Pa.

Principle is simple. The engine operating on a normal steam engine cycle is used as reducing valve between higher pressure side of gas dehydrator discharge line and lower pressure feed to a transmission pipeline. The differential pressure or cascading action furnishes power.

As it is only flow of gas through the engine that provides power, no gas is actually consumed by the engine or lost to the atmosphere, while engine is in operation.

At Falfurrias, Texas, on property of La Gloria Oil & Gas Co., such an engine is now in 24-hr daily service turning a pump. Engine develops 60 hp and drives pump that displaces water from a deep well at a rate of 500 gal per minute.

Such an application can be used by any industrial plant using natural gas. The engine provides a source of power to run compressors, electric generators, pumps, etc.

Such engines, in sizes ranging from 10 to 400 hp, are being manufactured by Troy Engine & Machine Co.

British plan biggest A-power station

With a capacity of 650 megawatts, the world's largest nuclear power station is being planned for Britain.

With the planning of this reactor, it is expected that by the 1970's nuclear reactors should produce half of the United Kingdom's electricity.

According to the British, th planning of bigger and bette reactors is the result of tech nical advances in reactor de sign. New developments i steel welding has made feasi ble construction of pressur vessels of greater thickness and hence reactors of fa larger capacity.

At the same time, technica advances in reactor design ar reducing appreciably capita costs of nuclear power station relative to their electricit output. Larger core size of th reactor, for example, plu greatly strengthened pressur vessels and improved fuel ele ments will enable reactors t operate larger and large amounts of uranium.

By 1962, the cost of powe the British say, is expected t be roughly equal to that o coal or oil-fired stations, pro vided that the nuclear station can operate on an 80 percen load factor.

Hydraulic, pneumatic symbols are standardized

A national standard fo graphical symbols to be use on hydraulic and pneumati circuit diagrams for fluid pow er systems is available.

A fluid power system is de fined as one that transmits an controls power through use o a liquid or gas within an en closed circuit.

Approved by the America Standards Association an published by ASME, th American Standard Y32.10 1958 shows basic symbols, de scribes principles on whic these symbols are based, an illustrates some representativ composite results.

Composite symbols can b devised for any fluid powe component by combining basi symbols. Copies of the stand ard — Graphical Symbols fo Fluid Power Diagrams—avail able at $1.50 each from eithe the American Standards As sociation, 70 East 45th St New York 17, N. Y., or fron ASME, 29 West 39th St., Ne York 18, New York.

Publishes standards on transformers

Standard requirements and terminology have been published for specialty types of transformers including general-purpose transformers, control transformers, machine-tooled transformers, Class 2 transformers, signalling transformers, ignition transformers, and luminous-tube transformers.

Titled "American Standard Requirements and Terminology for Specialty Transformers," the 46-page publication gives standards of ratings, dielectric strength, losses and impedance, regulation, temperature rise, construction, marking, service conditions, and definitions.

Called American Standard C89.1-1957, the publication is recommended for use in conjunction with American Standard C33.4-1958, "Safety Standards for Specialty Transformers," developed by Underwriters' Laboratories.

American Standard C89.1-1957 at $2.50 per copy, and American Standard C33.4-1958 at $1.00 per copy, available from American Standards Association, Dept. PR 20, 70 East 45th St., New York 17, N.Y.

Produces larger size Teflon hose

The manufacture of Teflon hose in sizes to 3 inches in diameter has been announced by The Manhattan Rubber Division of Raybestos-Manhattan, Inc.

The larger size hose is considered a breakthrough, as 1-¼ inches was the limit due to unusual surface characteristics of Teflon and manufacturing problems.

Sold under the Flexlon name, the hose can be made with a flange which avoids use of metal couplings.

Being able to stand temperatures up to 325°F, depending on size and construction, and with a glass-smooth surface, the hose is suited for handling a variety of materials.

CITY OF MANITOWOC INSTALLS SIXTH WICKES BOILER

R. E. Cannard—Chief Engineer and General Manager

Manitowoc Public Utilities Commission has just installed the sixth Wickes Steam Generator to help provide power for the City of Manitowoc, Wisconsin, and its surrounding area. The continued selection of Wickes equipment by this progressive municipality is a tribute to the dependability and quality of Wickes Steam Generators.

Wickes Boiler Co. builds steam generators for all branches of industry . . . for municipalities and for private and public buildings. Wickes units are available in sizes up to 500,000 lbs. of steam per hour and are designed for high or low steam pressures and temperatures, and for all types of fuels and firing methods. There is a Wickes design available for your needs.

Write for bulletin 55-1, showing the wide variety of designs and sizes available in both field-erected and shop-assembled* steam generators, or ask the nearest Wickes representative to call on you for full information.

*For the latest developments in shop-assembled boilers, investigate Wickes natural circulation A-type water tube units now built for capacities up to 75,000 lbs. per hour for oil and gas fuels. Request bulletins 56-1 and 57-1 for full information.

170

WICKES

WICKES BOILER CO., SAGINAW 15, MICHIGAN
DIVISION OF THE WICKES CORPORATION
RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Boston • Chicago
Cleveland • Dallas • Denver • Detroit • Houston • Indianapolis • Los Angeles
Memphis • Milwaukee • New York City • New Orleans • Portland, Ore.
Saginaw • San Francisco • Springfield, Ill. • Tulsa

Circle 9360 opposite covers.

FREE

NEW SERIES

HOW-TO-DO-IT ARTICLES

on Commutator and Slip Ring Maintenance

Years of experience are packed into this new 6-article series — each an invaluable guide for keeping commutators and slip rings at peak performance.

Each article discusses a major part of the overall problem — gives practical tips on maintenance — tells how to solve common problems — what to do and how to do it — in easily read shop language. Supplied in attractive folder, forming complete maintenance data file.

Designed as useful refresher reading and trouble shooting guidance for the veteran maintenance man . . . and a must for the new man just "breaking in" . . . the entire series has been prepared in close consultation with leading, nation-wide engineering authorities.

Mail the coupon for Article No. 1 now. Don't miss it — the remainder of the series will be sent to you at regular intervals, free and without obligation.

IDEAL Preventive Maintenance
Everything in equipment and methods for Commutator and Slip Ring Maintenance.

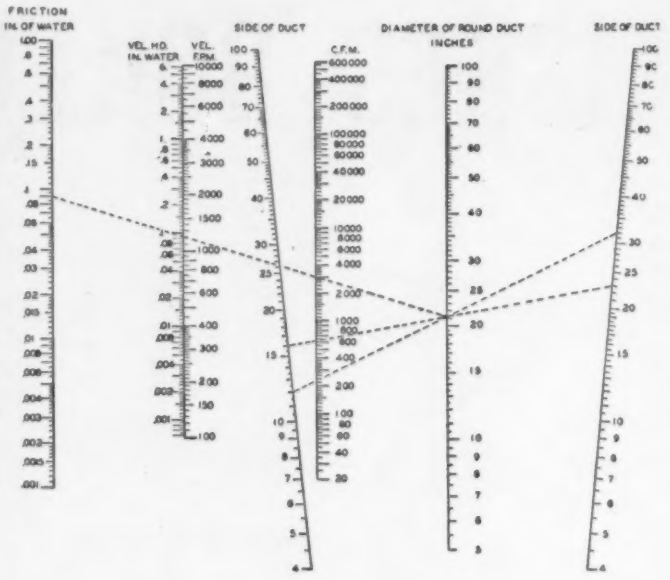
IDEAL INDUSTRIES
1022-A Park Avenue, Sycamore, Illinois
Please send free folder and article No. 1 of series "Commutator and Slip Ring Maintenance."

Name_____
Company_____
Address_____
City_____ Zone____ State_____

Circle 9361 opposite covers.

LETTERS

Your views are welcome in this column. Address "Letters, Power Industry, 111 East Delaware Place, Chicago 11, Ill." Letters should be brief and confined to the editorial of this magazine or other topics of interest to the plant and power services functions.



Here's an extension of duct nomograph

The nomograph "Circular Equivalents of Rectangular Ducts" on page 29 of the November 1958 issue of POWER INDUSTRY is interesting. However, to give at once the various other data which may be required, we made up the enclosed nomograph which we use principally for air conditioning problems.

Generally you start with the quantity of air to be handled and with a limit of friction and/or velocity. The round duct is obtained from which various rectangular ducts are obtained and also the velocity, in feet per minute or head in inches of water. Of course, if you start with the rectangular duct, the same procedure will give the equivalent round duct.

The nomograph was made from one which appeared in the December issue of "Heating, Piping and Air Conditioning" and copyrighted by Harold Morton, Minneapolis, Minn.

H. A. DODGE
Consulting Engineer
New York 17, N.Y.

• *For reader Dodge's nomograph see above.*

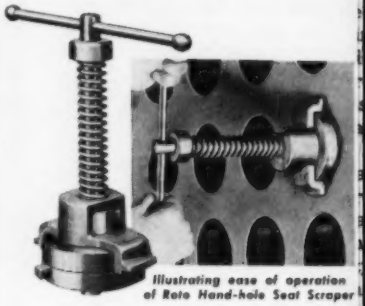
The particular example shown by the broken lines is: Assume 3000 cfm required with limit of 1200 fpm velocity. Lay straight edge connecting 3000 cfm and 1200 fpm. The friction will be 0.09" and a 20.2" round duct is required. Using 20.2 as pivot, swing straight edge around to read 16" x 23" or 12" x 32" or any other combination desired.

Keep ducts nearly square for economy of metal.

— The Editors

ROTO®

Hand-hole Seat Scraper



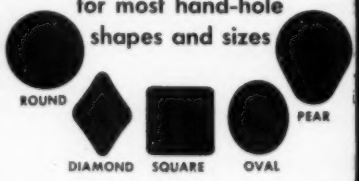
Illustrating ease of operation of Roto Hand-hole Seat Scraper

Eliminates tedious labor
Assures clean, tight fit

Roto Hand-hole Seat Scraper makes short work of cleaning dirty hand-hole seats. This simple, hand-operated tool has adjustable, spring-mounted retractable knives. A few turns to the right remove foreign matter without cutting the metal. A half turn to the left releases the tool, and the job is done. Customers say that the Roto Seat Scraper does the job up to 12 times faster than by any other method. Try one and you'll wonder how you ever got along without it.

Send for details.

Now available
for most hand-hole shapes and sizes



Standard Roto Seat Scrapers are available for the following equipment. Special types made to order.

Type of Boiler	Opening
Babcock & Wilcox ☐ 4	Round
☐ 61	Oval
☐ 70	Round
☐ 48	Oval
☐ 40	Oval
☐ 24	Oval
	Oblong
Bros	Round
Casey Hedges	Oval
	Oval
Combustion Eng ng	Round
	Oval
Edgemoor	Oval
Erie City	Ellip
	Oblong
	Ellip
	Pear
Foster Wheeler	Oblong
	Oblong
	Ellip
Geary	Oblong

Type of Boiler	Opening
Heine	Round
	Oval
International Boiler 2	Oblong
Keeler	Round
	Round
	Diamond
	Diamond
Lasker	Oblong
Murray	Oval
	Oblong
Oil City	Oval
	Oblong
Riley Stoker	Ellip
Springfield	Ellip
Union Iron Works	Pear
Henry Vogt	Ellip
	Oval
Walsh & Weidner	Oval
Wickes	Ellip
	Ellip
	Pear
	Round

ELLIOTT COMPANY
ROTO PLANT
Tube Cleaner Specialists Since 1910

151 Sussex Avenue, Newark, N. J.

Circle 9362 opposite covers.

JANUARY 1958
VOL. 75 NO. 1
POWER PLANT & POWER SERVICES INDUSTRY

How steam trap "surgeons" OPERATE at Eastman Kodak

The men who maintain some 60,000 steam traps at Eastman Kodak's sprawling Kodak Park must be as clean as a surgeon in a hospital — and in quite a few cases, they must literally work in the dark

Because some departments have to be kept super-clean, men servicing steam traps have to be as spotless as surgeons

Some of the film processing areas must be kept in total darkness, and the maintenance crews have to be familiar with traps to service them under this condition

M. RICHARD KONDOLF
Field Division
Kodak Park Works

TAKE into account some 10,000 steam traps to be serviced per year, add to that the fact that some are in production areas with unusually high standards of cleanliness, and then add the fact that some of these areas must remain in total darkness or under faint safelight illumination, and you have a trap maintenance problem of the first magnitude.

This is the task that faces the maintenance crew at Eastman Kodak's sprawling Kodak Park. Its 1000 acres contain over 125 manufacturing units producing photographic film, paper, chemicals and related products.

To keep these operations going, the Park has its own fifteen-boiler power plant, capable of producing more than 1,715,000 pounds of steam per hour. After the steam has run turbines to produce electric power, it is channeled off to take care of heating and processing requirements of the entire area. Some sixty thousand steam traps are needed for this purpose.

A Kodak mechanic who services traps in the dark areas has to be as familiar with his traps as the Army rifleman with his M-1 — he must be ready and able to remove and replace in darkness every bolt, nut, and gasket for a variety of traps.

In addition, to prevent contamination to film, the men have to wear super-clean, white nylon suits and caps as the uniform of the day. They look very much like surgeons in a hospital.

The outfits are pocketless so that no articles that might damage film will be carried inadvertently into these areas.

Fully attired in this dress, the mechanics must also go through a vacuum cleaning area to remove any last particle of dust. Minor cuts or bandages are another problem — they might contain medication injurious to the film being processed.

About 45,000 of the traps are thermostatic and float types used on low-pressure heating equipment. Thermostatic traps are maintained by various specialized field departments in the area. Maintenance is not high on this type of trap. They are often

(*Continued on page 34*)

INTRICATE TURBINE CONTROL SYSTEM

VINCENT S. WAGNER, De Laval Steam Turbine Co., Trenton, N. J.

WHEN the turbine installation was planned for the new 200-ton bleached draft mill of Thurso Pulp & Paper Company in Thurso, Quebec, several major problems had to be solved in reaching the final design.

It was evident that from the nature of these problems some unusual turbine design features and an intricate control system would be required, if the available steam was to be used efficiently and economically.

The heat balance study demonstrated that a special application of the single automatic controlled extraction turbine was the minimum turbine selection which could properly meet the design and first cost consideration.

Among the problems facing the new mill was the fact that it could not count on receiving supplemental or emergency electric power without prohibitive standby or first costs.

Wide variations in load demands constituted another problem. The 2400/4160 volt turbo-generator installation had to be designed with controls that could meet unusual steam and power demands. Load conditioning at the Thurso Mill will undergo wide changes as the mill shifts from weekend operations to full weekday operations, and from winter to summer operations.

During the weekends, with the mill almost completely shut down, load demands fall off considerably, since there is only a limited steam and power need for lighting and operation of small standby machinery. Thus, as steam and electric power demands rise and fall in a widely changing pattern, the load variations are expected to be in the ratio of 10 to 1.

The final design of the turbine and control system tied in intricately with the various steam supplies and load demands of the new plant.

Turbine Design

A unique aspect of the automatic extraction turbine is the use of a restricted exhaust end, designed for a straight condensing flow corresponding to a generator load of 2000 kw, instead of the normal full-load exhaust end.

The exhaust opening steam flow to the condenser is limited to 26,000 lbs per hour. The turbine exhaust is only 30 inches in diameter whereas the diameter of the controlled extraction opening for the 40 psig line is 24 inches.

The turbine, rated at 7500 kw, was designed for an inlet steam pressure of 425 psig and a total temperature of 700°F. The rated exhaust pressure is two inches mercury absolute.

The turbine is directly connected to a two-poled generator rated at 8313 kva with dual voltage rating of 2400/4160 volts, the latter rating being used in this case. The generator, which furnishes the three-phase 60 cycle current, contains a directly connected 40 kw exciter.

The turbine was designed for two extraction openings, one uncontrolled and rated at 135 psig, the other controlled and rated at 40 psig. The rated maximum uncontrolled steam extraction is 36,000 lbs per hour. At maximum throttle flow, when extraction at the 135-psig opening is zero, and the generator is operating at 7500 kw, the maximum rated controlled extract flow at 40 psig is 170,000 lbs per hour.

But once the uncontrolled extraction rated flow reaches 36,000 lbs per hour at the 135-psig opening, the maximum controlled extraction is rated for 135,000 lbs per hour for a rated 6700 kw generator load. Whenever the turbine is on total extraction, cooling steam in the amount of 4000 lbs per hour is passed to the condenser through an orifice in the secondary steam chest in order to protect the after stages of the turbine.

Steam Conditions

Steam is supplied to the turbine from a power boiler rated at 200,000 lbs per hour, operating in parallel with a recovery boiler rated at 100,000 lbs per hour. These boilers not only supply steam to the turbine-generator but also to the paper machine drive, the 125 psig and the 40 psig reducing stations, and the sawmill. In addition, the 425-psig boilers supply steam to the induced draft fans on each boiler, the booster pumps, the feed pumps, and a forced draft fan on the power boiler.

The turbines high pressure uncontrolled extraction opening, rated at 135 psig, supplies a pressure reducing station rated at 125 psig. Steam from the 125 psig header is used primarily by the digesters. When a small turbine loading makes the turbine steam supply insufficient at this extraction point due to insufficient stage pressure, the pressure reducing station in the 425 psig service line supplies the system entirely or will make up the difference as the case may be.

A header connects the 40 psig extraction turbine outlet to the paper machine turbine exhaust and two 425-40 psig pressure reducing stations. These supplies of steam are available to the evaporators in the pulp mill, the bleach plant, the heating system and the sawmill.

Intricate Control System

A special control problem resulted from the necessity to shift from reduced weekend operations to normal weekday loads, and from winter to summer loads. Weekend operations make up in hours a sizeable portion of the total operating week, which therefore dictated the use of a minimum size exhaust end for the estimated maximum straight condensing steam flow of 26,000 lbs per hour to get the maximum load for the best steam rate.

For example, as the shift is made from the weekend load to the regular weekday loads the operator must carefully watch the simultaneous build-up of electrical and steam loads. This must be done so that the former cannot exceed the latter and jeopardize proper control of the turbine unit since he ends up with more exhaust steam available than he has demand, the excess relieving to atmosphere.

The turbine is designed to carry full load at control extraction pressures, but if an excessive demand for steam at the uncontrolled extraction point were to be encountered (as it does on full drawdown by the digesters), the turbine would not be physically able to carry full electrical load.

HANDLES WIDE LOAD DEMANDS

To prevent this from happening, a pneumatic position transmitter was installed on the inlet steam valve servo motor to indicate when this motor is in the upper portion of its stroke. When this point is reached, a signal is transmitted to the pressure reducing station in the line from the 135 psig turbine extraction opening.

The effect of the signal is to throttle or close the valve to the 125 psig line depending on the severity of electrical load and the uncontrolled steam demand. Thus, steam which had been extracted from the uncontrolled opening is diverted and made available to the latter stages of the turbine exhausting either at the 0 lb psig extraction line or the condenser.

It is thereby possible to obtain the greater load carrying capacity from the steam. The maximum electric load will then be carried without difficulty. Such a system safely allows the advantages of a double automatic extraction turbine at a minimum of capital expenditure. This arrangement although possible for this type of application is only practical because of the nature of the operation.

The turbine speed governor is a standard 60 cycle AC generator transform oil pressure governor; the extraction regulator is a De Laval standard unit. But units have been attenuated to handle the rapid fluctuations in both electric loading and steam demand that occur in the paper mill operation.

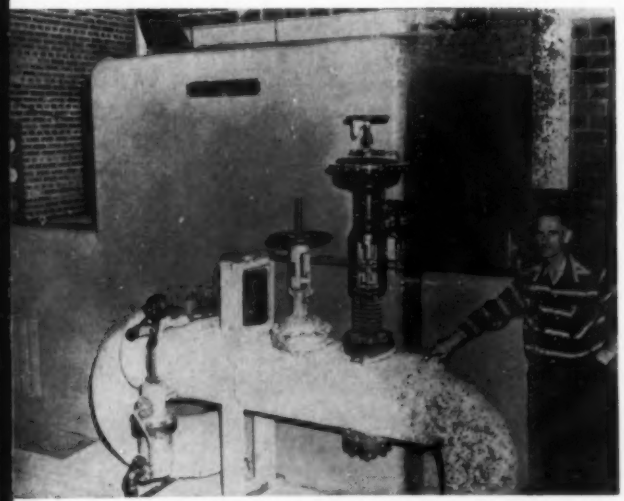
Rapid steam demand fluctuations result from instantaneous drawdown to fill the huge evaporators and digesters. Once a steam valve has been opened to pressure these vessels, a tremendous volume of steam is required instantaneously, which results in a sudden reduction in header pressure. The extraction regulator meets this situation by supplying all the steam possible from the turbine.

When the turbine supply has reached its limit, the pressure reducing stations then supply the remainder. The instantaneous steam load demand tapers off as the pressure between the vessel and header equalizes. As the header pressure recovers, the pressure reducing stations are first cut down to zero flow, and then the extraction from the turbine is adjusted to the normal supply by re-positioning the primary and secondary valves.

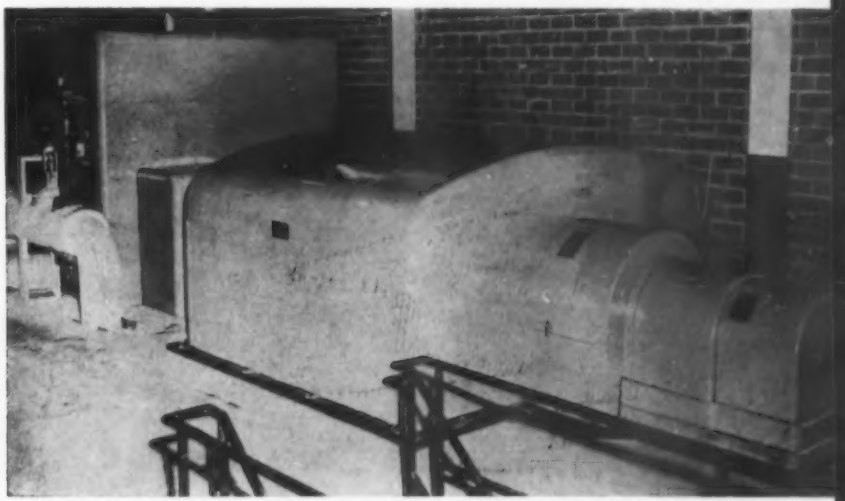
Instantaneous drawdowns usually occur periodically in normal operation and the flow is in the magnitude of 60,000-100,000 lbs per hour. The extraction regulator controls, therefore, must be set not only for accurate response for the good steady state conditions, but also for instantaneous response to these tremendous, rapid fluctuations.

In time, the steam valves in the mill may be operated more slowly in order to reduce the strain on the boilers due to the drawdowns. But since the controls are responding well to the present demands placed on them by these rapid fluctuations during startup, they are expected to continue to respond even better once the

To page 31



The reducing station takes steam from the turbine's uncontrolled extraction point for the 125-psig header. Control system allows it to work in conjunction with electrical load



Generator installation at Thurso Pulp & Paper Co., Quebec, Canada, where intricate turbine control system will handle wide load demands

We Are Being Misled

Upon returning in November from Europe where he attended the Atoms for Peace Conference at Geneva as a representative of the US Atomic Energy Commission and the State Department, Dr. Wilson completed this story for POWER INDUSTRY.

His attendance at that conference is just one of the many activities in which he has participated in this field. He is a member of the General Advisory Committee to the US Atomic Energy Commission and has served on several other committees in addition to giving numerous talks on the subject.

His long history of industrial activity was climaxed by a thirteen-year period as chairman of the board of the Standard Oil Company (Indiana) — a position from which he retired in 1958.

A member of numerous societies and holder of honorary degrees from some 15 colleges and universities, Dr. Wilson includes 90 patents in his activities in scientific circles.

At the present time, he headquarters at his office at 135 S. LaSalle St., Chicago 3, Ill.

If anyone claims that the Atomic Energy Act has turned over to private industry a power bonanza in the form of already solved technical and economic problems, either he does not know the facts or he is an arrant demagogue.

Any private investment in commercial atomic power generation in this country in the near future will have to be inspired more by long range hopes and public service motives than by any reasonable expectation of substantial early profit.

When we start to talk about the possible use of nuclear fuels in central power stations, I think it is fair to describe the present situation as confused. It is confused partly because of misunderstandings on the part of the public and partly because even the experts hold varying opinions, though not as varied as some published reports would indicate.

According to one published claim, a plant in California will be able to make electricity in 1962 for less than 9 mills per kwh. Another estimate predicts nuclear power costs by 1980 as low as 2 mills!

On the other hand, electricity from the plant in Shippingport, Pa. — the only large plant in actual operation — has been said to cost 64 mills.

The mere cost of fabricating the fuel elements — one factor often overlooked in the past — was about twice the cost of conventional power!

For large conventional steam power plants today, the cost range is around 3.5 to 8 mills depending on size and location.

Is atomic energy from unsubsidized plants likely to get down into that range within the next few decades?

I yield to no one in my admiration for the research done in government, university, and industrial laboratories on the many problems involved in producing power from atomic fuels.

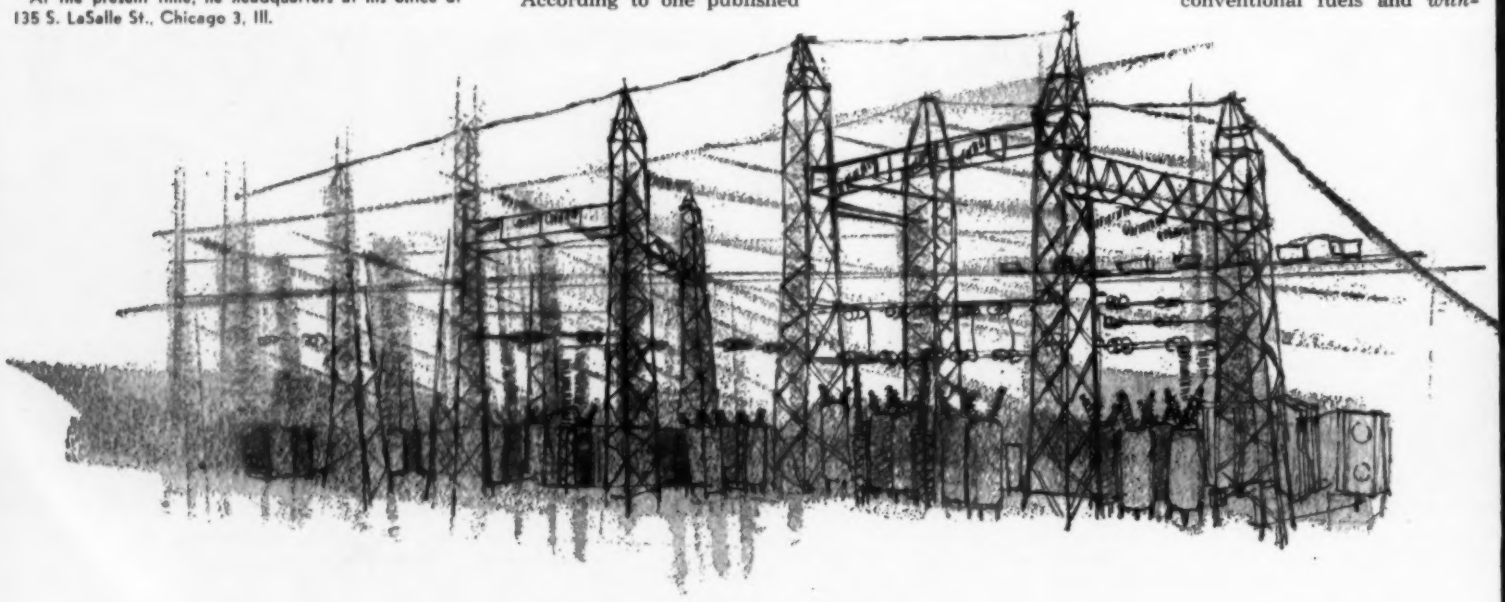
However, I think it is fair to say that this research has uncovered almost as many new problems, unsuspected in the early days of rosy optimism, as it has fully solved the problems then recognized.

That is not surprising because the military aspects of atomic energy have necessarily had priority during most of the hectic years since the war. The research achievements in that area have been truly amazing.

What is Commercial Nuclear Power?

In discussing the probable rate of development of the commercial use of atomic energy, I should first define what I mean by commercial use.

Basically, I mean production of power at costs (including depreciation) that are competitive with power from conventional fuels and *with-*



on Nuclear Power

DR. ROBERT E. WILSON
Former Chairman of Board,
Standard Oil Company (Indiana)

out direct or indirect subsidy.

I use this criterion because it is hard enough to appraise the complicated economic factors that will affect the rate of development, without trying to take into account the unpredictable political and other factors that might lead to all sorts of open or concealed subsidies.

Most of those individuals, either in government or industry, who predict early commercial developments by private enterprise are tacitly assuming such subsidies in one form or another. I am not implying that some subsidies cannot be justified in this important new field, but they nevertheless are subsidies.

Basis for Unsubsidized Plants

Specifically, I consider that to qualify as unsubsidized a commercial power development:

- Would have to be set up on the basis of financing at commercial rates, paying the usual taxes, and making a reasonable profit on the total investment, while charging rates no higher than necessary for a modern plant using conventional fuel.

Since capital costs will be much higher than for conventional power plants, these factors are highly important in determining whether or not a nuclear plant is really competitive.

- Would have to provide a plant location, safety devices, shielding equipment, and provisions for waste disposal substantially as safe as those of the existing atomic piles. While this factor of safety is costly, and may well be higher than needed, as a practical matter it will probably be many years before any political subdivision would feel that it could permit substantial relaxation of present precautions.

Also, full commercial liability insurance for a plant located in a well-populated area is likely to be either unobtainable or prohibitive in cost for many years.

While putting the reactors underground or inside huge steel shells may well decrease the area required and permit building plants closer to populated areas, these alternatives also cost money.

- Would pay for its uranium (or other fissionable material) either by outright purchase or on a rental basis that fully covers at least the average going cost of the government. (The government now pays different prices to different uranium producers, depending largely on their costs.)
- Would get no long-term, government-guaranteed price for plutonium, which is produced as a by-product in most power-generating reactors. Although the government is now producing plutonium at rather high cost for weapons, and will need still more for some time if the nuclear arms race continues. (We hope that does not continue indefinitely.)

The plutonium would have value for generating power, but there are substantial difficulties to be overcome. To determine such possible value, a commercial plant would have to figure on paying the cost of separating and recovering its by-product plutonium, and develop safe ways to use it up in its own power-generating operations. This problem is not fully solved as yet.

Fewer Plants as a Result

Defining unsubsidized commercial power in this way, I believe most experts will agree that *there will be few, if any, unsubsidized atomic power plants built in this country for purely commercial purposes before* 1968.

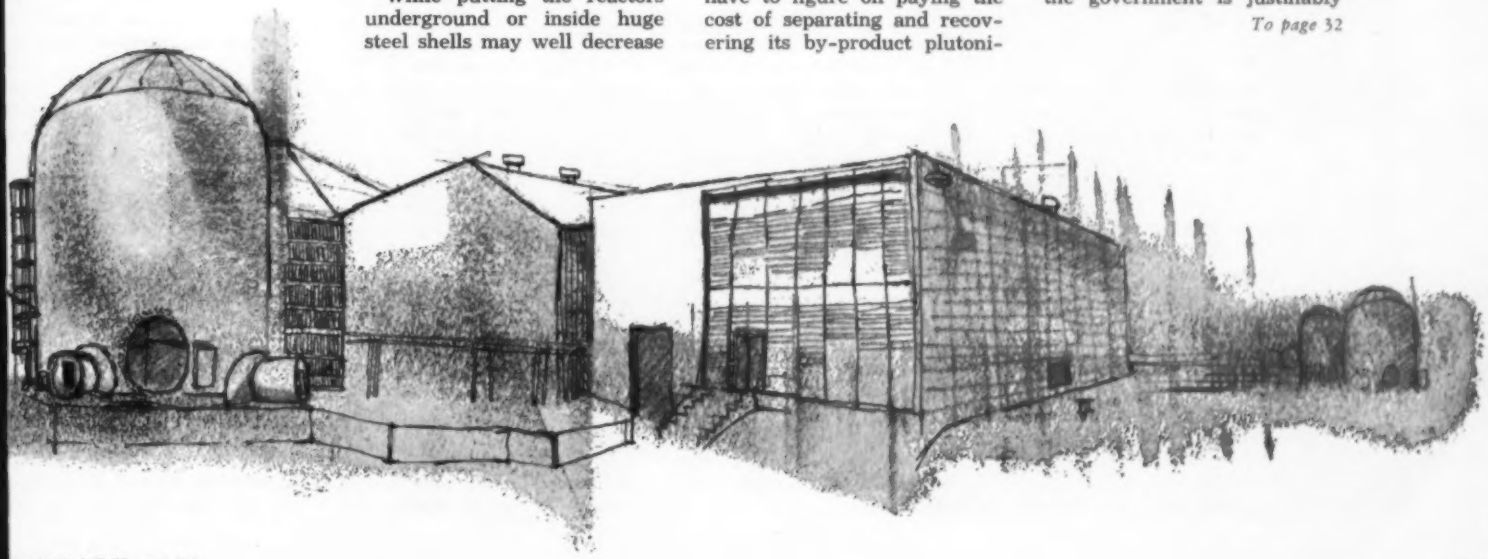
These "few, if any" would be only at points remote from conventional fuel supplies, and with high load factors.

The above statement might appear to be questionable in view of the various announcements of so-called commercial plants, at least six of which are supposed to be completed by 1960.

If you check into them, however, you will find that *not one of them qualifies under my definition of an unsubsidized commercial plant.*

For the first—the Shippingport, Pennsylvania, plant—the government is justifiably

To page 32



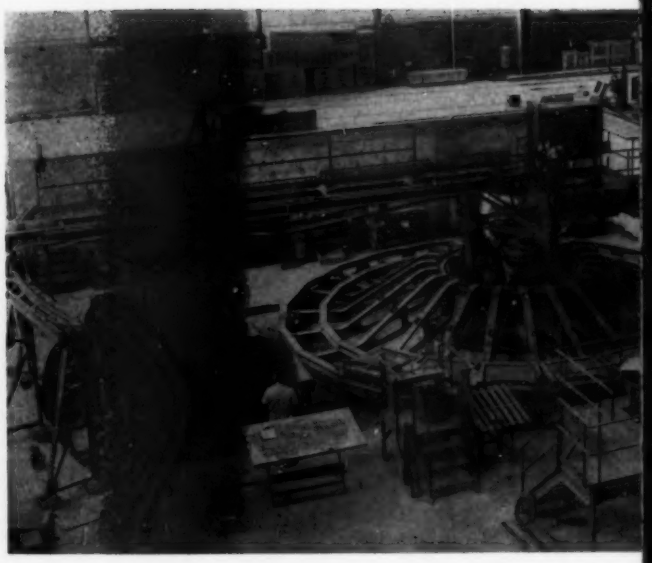
Plan Ahead on a Power Service

Planning ahead is good practice, especially when it concerns the power service system for a new industrial plant. A lot of thinking for the future will solve a lot of headaches when expansion does come

Such an example of proper planning is Reading Metals Refining Corporation's new plant. Their planning looks far into the future. The following article tells how they tackled the job of handling step-by-step expansion

SIDNEY DRESSLER
Electrical Engineer
Reading Tube Corporation
Reading, Pa.

GLENN R. TAFT
Application Engineer
General Electric Co.
Philadelphia, Pa.



In January 1956, the Reading Tube Corporation — manufacturers of copper and brass tubing — tackled the job of expanding its limited casting department and the additional task of providing itself with a copper refinery capable of supplying anticipated demands of the new casting facilities.

The result is a new four-million-dollar plant capable of supplying the original cold-drawing mill with all the castings it can presently process — with provisions for future expansion. This new plant is known as the Reading Metals Refining Corporation. Its ultimate load will be 12,000 to 15,000 kva.

Because of physical limitations at the old plant in Reading, Pennsylvania, a new site was selected just north of the city. Comprising some ninety-seven acres, it is considered ample for anticipated future growth.

The power service system was designed accordingly — to expand with the load. Three utility lines cross the property — two at 69 kv and one at 13.8 kv. Either 69-kv line is capable of supplying the entire plant load, while the 13.8-kv line is adequate for emergency use. Process water is available from the Schuylkill River, which bounds the property on one side.

Power Service System

All basic elements of the power service system are required to supply this initial load — main substation, primary switchgear, load-center substations, rectifiers and motor-control centers. Each was designed for expansion in step with load requirements.

In order to limit investment in the electrical system to services essential to each stage of plant development, it was necessary to select the one type of system which lends itself readily to step-by-step expansion, i.e. load-center distribution.

In this type of system, unit substations are designed and located according to the loads they will serve; new substations are added as required; distribution from source to substations is at intermediate voltage.

Either 4160 or 13,800 volts is capable of serving the expected ultimate load of 12,000 to 15,000 kva. The latter was chosen because of the 13.8-kv utility line on the property, which may be used for emergency service. This choice also permitted one of the unit substations to be used early in the construction period for temporary power while the main 69-kv substation was being erected.

Long-Term Program

In final development there will be two 7500/9375-kva transformers, each supplying a separate bus section of the 13.8-kv switchgear. Each bus will operate as a separate unit under normal conditions. To provide for maintenance and abnormal conditions, a tie breaker is included for interconnecting the buses and serving them collectively from a single transformer.

The interrupting rating of all 13.8-kv breakers is adequate to permit interconnection with both transformers in service; hence switching may be performed without service interruption.

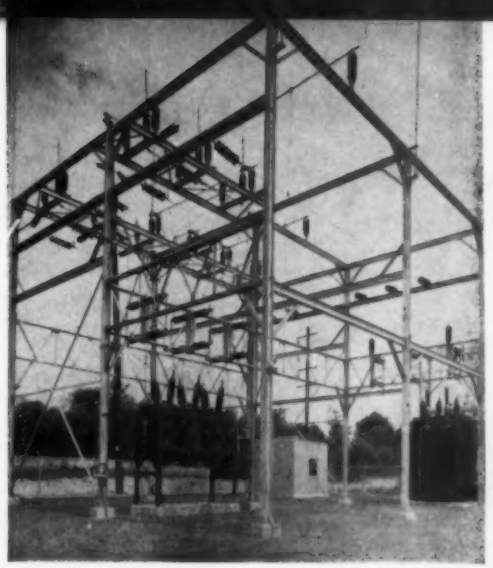
Local distribution at 13.8 kv will be divided on the two-bus sections so as to obtain approximately balanced loading of the two transformers. Forced-air cooling provides ample capacity for all essential loads to be placed on a single unit.

Unit substations, in most cases, will be double-ended, supplied from separate bus sections of the 13.8-kv switchgear. Normally open, low-voltage tie breakers bring dual service all the way to utilization level.

This secondary-selective circuit arrangement, operating at 480 volts, was chosen because it combines practical dollar values and quality service. Normally each half-unit substation operates independently as in the radial-type system.

In the event of an interruption on one of the source circuits, service may be re-

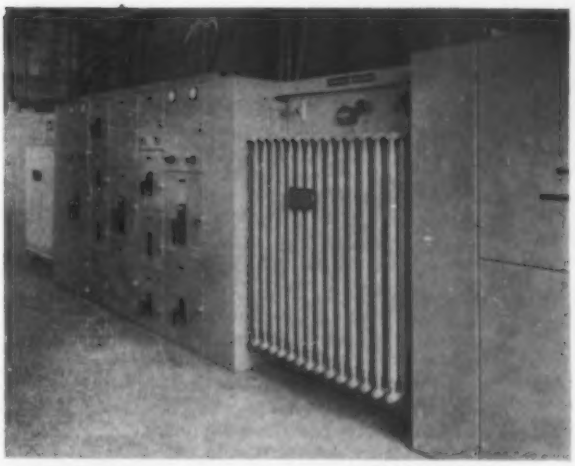
System



1 ▶

2 ▲ 3 ▼

6 ▲



1) Main substation at present stage of development. 69-kv oil circuit breaker (center) controls 7500/9375-kva transformer (right). Relays and control devices are located in the enclosure. Provisions are made for inclusion of a second transformer

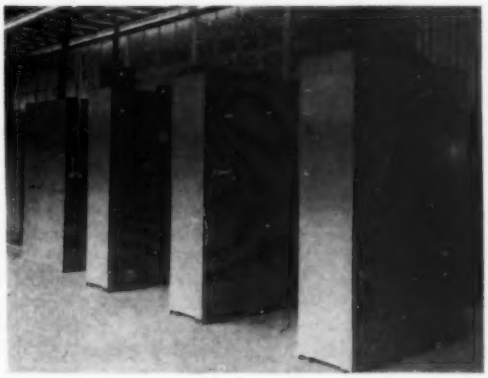
2) 13.8-kv incoming lines terminate at wood-pole structure. Rubber-insulated cables with stress cones carry power from this point to indoor switchgear. Cable is supported by suspended aluminum racks for easy installation and future accessibility. Lightning arresters protect the junction

3) Typical double-ended indoor unit substation, 1500 kva, 13,800-480Y volts

4) Bus runs 400-ft long, supplies electrolytic process and consists of eight ½" x 8" butt-welded aluminum bars, spaced for ventilation and suspended on insulated hangers

5) Free-standing, metal-enclosed motor-control centers are located throughout the plant close to the loads they serve

6) Present state of production unit. Power service system is designed to expand easily with future expansion. Here molten copper from the reverberatory furnace (right) is poured into molds at the automatically controlled anode casting wheel (center). From this point anodes are moved by industrial railway to the tank house for electrolytic refining



5 ▲

4 ▶

stored promptly by opening the main secondary breaker and closing the bus tie-breaker. Similar procedure makes primary maintenance easy and safe.

Immediate Program

Power requirements for this first stage of development are approximately one half the expected total. By carefully planning the system arrangement, initial capital investment in power equipment was limited essentially to services presently required. Succeeding stages will be developed by adding units as needed, each stage standing on its own from an accounting standpoint.

Only one main transformer and three distribution circuits

To next page

Power system

From preceding page

are required for this first stage. Consequently the main substation and 13.8-kv switchgear are completed only to this point.

This does not afford the full flexibility of two main transformers and a split-bus switchgear arrangement. To compensate, an additional circuit breaker was included in the switchgear lineup and connected temporarily for standby 13.8-kv service from the utility. This unit eventually will become the bus tie-breaker, making it possible to expand the switchgear without service interruption.

Unit Substations

The two double-ended unit substations are identical in rating: 750-750 kva, 13,800-480Y volts. It is expected that future units will be the same to secure the advantages of duplication — minimum spare parts, standardization of maintenance procedure, interchangeability, etc.

This rating was chosen because it is an economical size for 480-volt service; short-circuit duties are moderate and permit even the small air circuit breaker to be applied on a fully rated basis. In each case loads are balanced as closely as possible to obtain a margin of reserve capacity at each transformer for future growth and emergency use.

The River Pump substation, though remote and extremely important to the operation, is single-ended, rated at 500 kva. In view of the excellent service record for this class of equipment, dual facilities for this relatively small load did not appear to be justified.

Protective equipment and construction details were given special attention; the probabilities of interruption at this location are considered extremely remote. River pumps, rated 100 and 250 hp, are not planned to operate simultaneously; however, a 500-kva rating was chosen to make simultaneous operation possible, and to limit voltage dip on starting. Full-voltage starting is used.

Delta-wye transformation and system grounding are used at both voltage levels to prevent transient overvoltage, to provide better relaying, and for better over-all safety.

Grounding of the 13.8-kv system is at the main transformer neutral; the second unit will be similar. Ground faults are resistor-limited to 600 amperes, adequate for proper functioning of relays.

Each feeder circuit is equipped with a sensitive fast-acting residual relay which operates within twelve cycles to trip the breaker and isolate the fault from the rest of the system. A slower-set relay located at the main breaker gives backup protection.

A third relay, connected in the transformer grounding lead itself, is set still slower, yet as fast as possible to obtain coordination. This relay operates only on the occurrence of ground faults on the 13.8-kv supply line to the main bus or within the transformer itself — trips both primary and secondary breakers, interrupting service until the fault is located and isolated by manual switching.

A disconnecting switch in the grounding lead — an unusual feature — is provided for the purpose of ungrounding the 13.8-kv system during short periods when the 69-kv breaker is bypassed for servicing. Under these conditions the only 69-kv protection is the relatively high-set relays of the utility — not sufficiently sensitive to operate and interrupt a limited ground fault on the 13.8-kv system.

All 480-volt source transformers are wye-connected and solidly grounded. This is common practice for low-voltage systems where ground faults must be of sufficient current magnitude to trip phase-fault protective elements — mostly direct-acting trip devices integral with low-voltage air circuit breakers. Minor faults will be cleared and isolated by branch-circuit fuses or low-set devices located in the motor-control centers.

A relay study was made for the entire system; overcurrent settings were chosen which should result in selective operation of both phase- and ground-fault devices for troubles occurring anywhere in the plant.

Rectifier Equipment

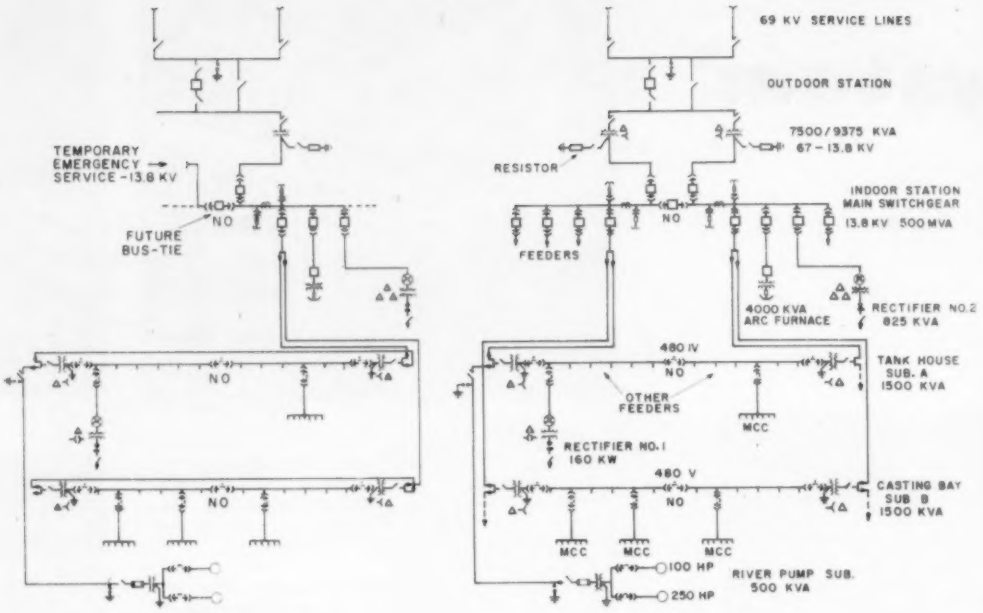
Germanium liquid-cooled rectifiers were chosen because of their excellent conversion performance at low voltages required by the refining process. Each rectifier equipment consists of an induction voltage regulator, transformer, two germanium rectifier sections, an operator's control panel, DC switching and measuring devices, cooling system and accessories — all designed to operate as a coordinated unit.

One rectifier serves the Stripper and Commercial Sections of the copper refining process, and is rated 825 kw. Its AC source is 13.8-kv through a circuit breaker located at the main switchgear, controlled from the operator's panel.

The rectifier for the Depositing-out Cell line is rated 160 kw, 8000 amp, 20 v. It receives power from one of the 750-kva, 480-v unit substations through an electrically operated air circuit breaker, with control located at the operator's panel. The induction regulator is capable of varying DC voltage from 2 — 20 volts and can automatically control current from 40 to 100 percent of 8000 amperes.

Germanium rectifier sections of both are perchloroethylene-cooled to dissipate the heat generated in the rectifier

One line diagram of power service system



stacks. River water, circulating through heat exchangers, cools the "perc." A forced-air cooling system is used on the smaller unit to control temperature of the dry-type rectifier transformer. The larger unit has a Pyranol-filled transformer which is self-cooled.

Motor-Control Centers

Present equipment includes five motor-control centers supplied at 480 v through air circuit breakers located at the unit substations. Each is a free-standing, metal-enclosed unit. Both fused- and circuit breaker-type combination motor starters are used, depending on size and individual function.

Each independent starter has its own control-power transformer. Where several starters are combined in a coordinated operation (as for the two casting wheels), control power is obtained from a common dry-type transformer. Three feeders furnish power for 480-v portable welders and are protected at the motor-control centers by molded-case air circuit breakers of suitable rating.

All starters and circuit breakers are removable for easy maintenance. Ample capacity and spare spaces were provided for future expansion; provision is made for additional equipment when needed.

Wiring

Primary feeders are all 15-kv interlocked-armor, three-conductor, rubber insulated, with stress cones and clamp connectors at the terminations. Low-voltage power and lighting feeders are also interlocked-armor, rated 600 v.

These flexible cables are installed on suspended aluminum racks — a type of construction proved to be less costly than conventional cable-in-conduit; future additions are easily made; maintenance is simplified by the fact that cables are constantly visible and accessible.

The entire plant is lighted with mercury-vapor type units, supplemented by a suf-

To page 32

How Much Steam Should a Steam Trap Trap?

. . . some answers to commonly asked questions about the primary job of a steam trap

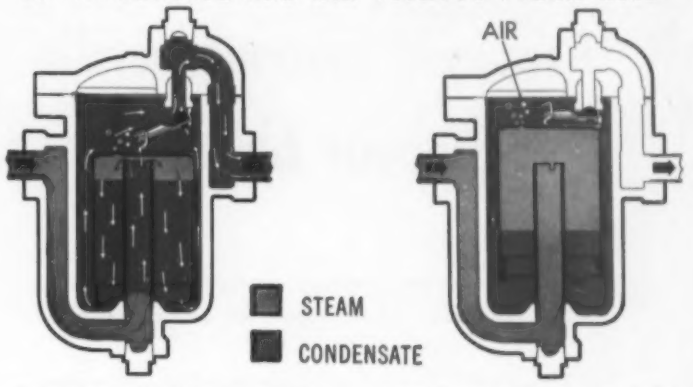
You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

A Steam Trap Should Remove Air and CO_2

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. CO_2 goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. O_2 aggravates the situation. Believe it or not, but all traps don't properly remove air and CO_2.

By now, you've probably guessed that Armstrong traps *do* remove air and CO_2. Armstrong design (see illustration) provides continuous venting of air and CO_2. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.

What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

* * *

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

Armstrong Machine Works
8201 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

Circle 9363 opposite covers.

NEW DEVELOPMENTS

plant services — power services maintenance

Packaged systems handle continuous blowdown

Heat recovery systems increase usefulness of blowdown heat content; are self-cleaning

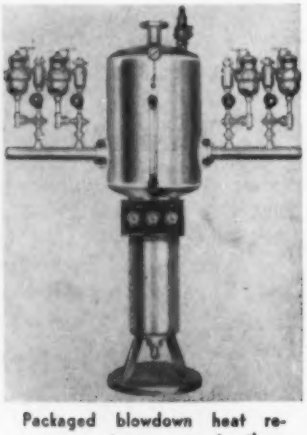
Making it possible to recover up to 85% of the heat in blowdown water, continuous blowdown heat recovery systems aid in getting the most out of your heating dollar.

Such a system comes as a packaged unit containing all components and requiring minimum amount of piping to complete the system. System recovers the heat contained blowdown water in the form of flash steam.

This steam may be directed to feed-water heating or for either process work or general heating. It can then subsequently be returned to the heater in form of condensate.

In either case the amount of make-up water is reduced proportionately.

The packaged unit contains an orifice-meter flow control which is accurate through 17 different flow rates.



Packaged blowdown heat recovery systems come in three sizes

Gravity flow of the blowdown water is maintained throughout system, and thereby eliminates need of mud traps. Continuous flushing of the system is accomplished by a balanced-pressure flow valve that allows a continuous stream of water to flow through the equipment at all times.

A gage panel attached to the unit quickly and easily indicates inlet and outlet exchange water temperature and temperature of blowoff drain. Designed for boiler pressures to 250 psig and total blowoff of 5000 lbs per hr, one unit will handle up to as many as six boilers.

Requiring less than three feet square of floor space and standing no more than 106 inches high (for largest unit), three different size units are available. Shipping weights range from 1200 to 1400 lbs.

(Package blowdown heat recovery systems are manufactured by The Madden Corporation, Dept. PI, 1345 Jarvis Ave., Chicago 26, Ill.)
Circle 9364 opposite covers.

Enables engines to start no matter how cold

Even in temperatures down to −65°F, device eliminates difficulties in starting all types of internal combustion engines in cold temperatures.

Called the "Gasifier Primer," the device is a self-heat-generating unit which vaporizes liquid fuel and blends the vaporized fuel with air to form a combustible mixture which is readily ignited in the engine cylinders.

Unit vaporizes fuel and blends it with air to form mixture which can be ignited in cold engines

It has no moving parts to clog, gum, or stick. Small, compact, and light-weight, it operates on either 6- or 12-volt systems.

(Reichhelm Gasifier Primer is manufactured by The Houston Co., Dept. PI, PO Box 417, Wallingford, Conn.)
Circle 9365 opposite covers.

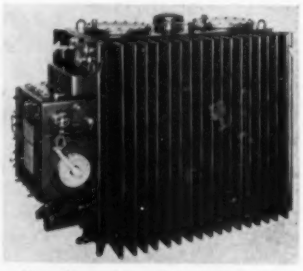
Network transformer more compact, lighter

Design changes have been incorporated in vault network transformer to make it lower, lighter and more compact. Size and weight have been reduced about 15 percent.

Having a corrugated surface, tank's design increases cooling area over conventional tubes. All of tank's radiating surface is accessible for painting. End corrugations are notched to form lifting hooks.

Welding is used wherever possible to eliminate gasket maintenance by keeping bolted openings to a minimum. New core steel applications and insulator techniques make compact design possible.

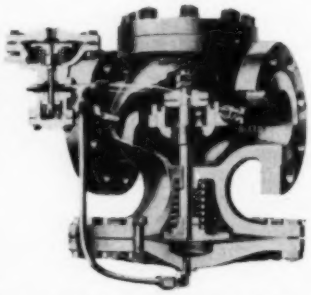
(Vault network transformer is manufactured by Allis-Chalmers Mfg. Co., Dept. PI, Milwaukee 1, Wis.)
Circle 9366 opposite covers.



Transformer's tank design has corrugated surface and increases cooling area

Air-loaded pilots operate from remote panels

A series of air-loaded pressure and temperature pilots have been developed for use with manufacturer's standard line of main valves.



Air-loaded pilot (cutaway view, top left,) was developed for use with manufacturer's main valves

The air-loaded pilots are interchangeable with pilots of existing regulators. Adjustment of the air-loading from a remote control station permits easy adjustment of control setting of the pilots.

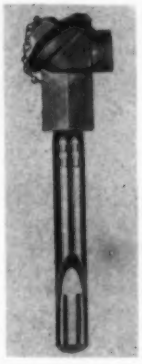
An air control-panel has been developed for use with these pilots and includes supply loading air gages, non-bleeding pressure control valve, and an optional delivery pressure gage.

(Air-loaded pilots are manufactured by Spence Engineering Co., Inc., Dept. PI, Walden, N. Y.)
Circle 9367 opposite covers.

Thermocouple holds up under high temp

Using a different concept in design, heavy-duty, fast-responding industrial thermocouple will remain straight and rigid for an indefinite period in temperatures up to 2200°F. It can easily be removed from the furnace without damaging wall.

Instead of using loose fitting insulator beads, the thermocouple has a hard ceramic pack which forms a solid core. This core together with a extra-heavy wall (schedule 60 instead of 40) makes the unit sag-free.



The heavy protecting tube contains two #8 B&S gage wires completely imbedded in the solid ceramic. For installation, it is not necessary to twist the wires first as the thermocouple is easily fabricated in the field by welding over a hot junction end. Weld material serves as a conducting pad.

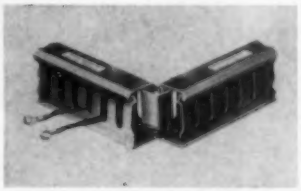
Units can be ordered in nominal 20-ft lengths or as complete thermocouple assemblies. Three sizes are available: ½", ¾", and 1" standard pipe diameters.

(PermaKouple and accessories are manufactured by E. C. Smith Mfg. Co., Dept. PI, Forest & Hector Sts., Conshohocken, Pa.)
Circle 9368 opposite covers.

Provides smooth corners at wiring duct joints

For facilitating wiring duct installation and providing smooth rounded corners at all junctions, corner piece has been designed for use with manufacturer's plastic wiring duct. It is a plastic right-angle piece, slotted at each end of angle bend to receive side walls of connecting duct sections.

Slots incorporate an overlapping leg design which allows quick, easy attachment yet grips duct firmly. Made of high-temperature polyvinyl chloride plastic, it is nonflammable with no after-glow.



Plastic corner duct facilitates installation and provides smooth corners

It is flexible, tough and durable. Supplied in five foot lengths, corner piece is easily cut with fine-tooth saw to correspond to any duct height.

Corners for any of the 19 sizes in three types of straight duct can be fabricated from this one style of corner piece.

(Corner-strip is manufactured by Panduit Corp., Dept. PI, 14461 S. Waverly Ave., Midlothian, Ill.)
Circle 9369 opposite covers.

How much iron in water? Here's simple way to test

Fast, easy, accurate determinations of iron content in water and brine are done colormetrically by simple apparatus.

Compact and rugged, testing unit consists of eight color standards to cover 0-10 ppm iron range housed in transparent plastic block, together with glass comparison cell, two reagents with droppers, a mixing tube, cell cleaner and complete instructions.

Range of color standards can be extended by diluting sample with iron-free water.

Operation is simple — mixing tube is filled with sample to be tested and reagent is added. After allowing this solution to stand 15 minutes, it is placed in tester block and compared with color standards. Values are read directly from standards which are guaranteed against fading.

(Midget iron tester is manufactured by W. A. Taylor & Company, Dept. PI, 7300 York Road, Baltimore 4, Md.)
Circle 9370 opposite covers.

Supplies stand-by fuel during gas cutoff

To maintain heat processing operations, space heating, water heating, cooking or refrigeration during periods of fuel cutoff, a "Propane Diluter" automatically supplies accurate mixtures of propane and air, or butane and air.

Device supplies accurate mixtures of propane and air, or butane and air

Available for any size installation, the device provides simplified interchangeability without adjustment of appliances or gas burners. Can be connected to existing gas piping and eliminate need for dual piping, separate air blowers, inspirator mixers.

Its design incorporates a balanced pressure, full-floating mixing valve with precision machined gas and air metering ports. Valve is adjusted through a vernier worm-wheel mechanism for precise control of gas-air ratio. It is capable of turndown through a range of 50:1.

Additional features include: delivery of gas-air mixtures at pressures sufficiently high to produce same heating rates as normally attained, maintenance of constant pressures under load variations, maximum flame speed and combustion efficiency.

(Propane Diluter is manufactured by Selas Corporation of America, Dept. PI, Dresher, Pennsylvania.)
Circle 9371 opposite covers.

For more information on items reported in the New Developments section, circle corresponding numbers on reader service card opposite inside covers.

Brings boiler water levels and other liquid levels down to convenient eye-height—accurately and brilliantly. Over 12,000 in use. For free Indicator Book, write YARNALL-WARING Co., 100 Mermaid Ave., Philadelphia 18, Pa.
Branches in all principal cities.

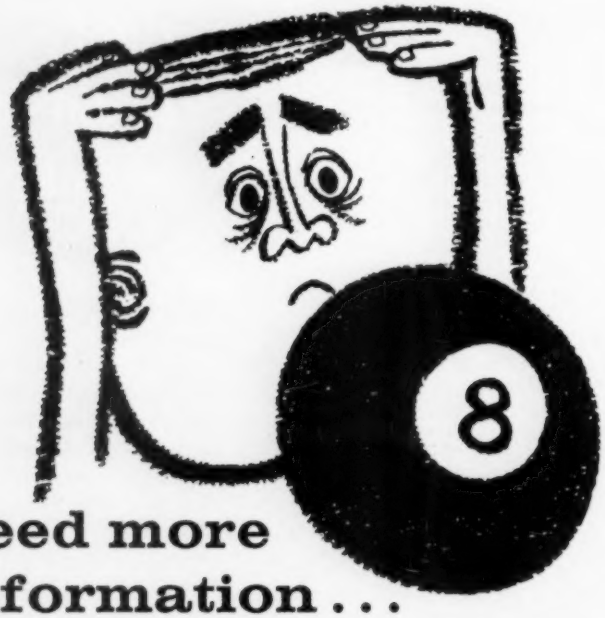
go YARWAY with confidence

Circle 9372 opposite covers.

Replacement Tubes

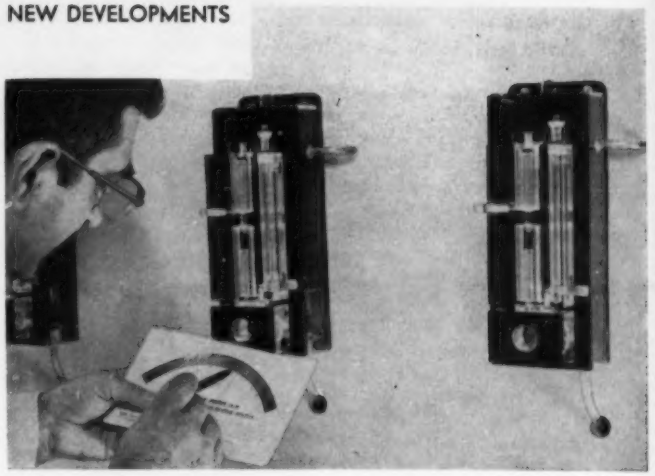
BOILER TUBE
COMPANY OF AMERICA
McKEES ROCKS, PA. (Pittsburgh District) Federal 1-7750

Circle 9373 opposite covers.



need more information . . .

Note there is a key number at the end of editorial articles or advertisements. To request more information circle the proper number on the convenient card opposite the last page. Send the form to us . . . we do the rest. Information comes direct to you. No obligation of course.



Simple method for continuous monitoring of such boiler water analyses as pH, hydrazine content, hardness, or phosphate content is possible with this chemical analyzer. Unit has no moving parts and is powered entirely by gravity head of sample. It can be connected to photocell to actuate alarm if water condition becomes unsatisfactory

Automatic Colorimetric Boiler Water Analysis

— it's simple, relatively inexpensive with newly developed instrument

HAVING no moving parts and requiring no electric or pneumatic power, a chemical analyzing instrument makes continuous colorimetric boiler water analysis simple and inexpensive.

Untrained operators using the instrument can make tests that formerly required skilled technicians — and make them with foolproof accuracy in a fraction of time.

Here's how it works: After passing through a sample cooler, boiler water sample enters a reservoir at top of the instrument, where an overflow tube maintains a constant level.

From the reservoir, sample then flows by gravity through an adjustable orifice to a sample metering chamber, where it slowly rises to top of a syphon tube. As soon as this point is reached, the entire contents of metering chamber (19 cc) are discharged by syphon action to reaction chamber below (See schematic diagram).

Flow rate through adjustable orifice determines testing rate of instrument and can be regulated to run automatically from 4 to 60 reactions per hour. All phases of operation are easy to observe because the instrument is made almost entirely from transparent acrylic plastic.

During first part of cycle (while metering chamber is slowly filling) colorimetric reagent flows from reagent reservoir into reaction chamber. Standard reservoir has enough capacity for one day's operation — larger ones are available.

Normal setting of a mariotte tube admits precisely 3 cc of indicating reagent to reaction chamber for each cycle. As sample and reagent mix, their combined volume is sufficient to rise over the top of

second syphon, discharging entire mixture (22 cc) into lighted optical cell below. Here the color can be observed and compared with color standards.

For more automatic operation, a photocell unit can be connected to optical cell to monitor color change and actuate an alarm if water condition becomes unsatisfactory.

Because optical cell volume is only 8 cc, it is flushed out with twice its volume before the last portion of mixture is retained. The cell is never empty, and each sample has traces of previous sample in it — amount is slight and should present no problem.

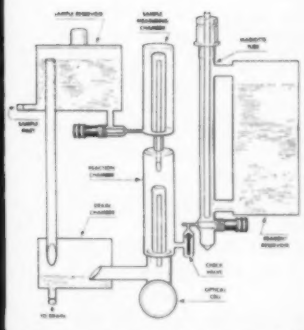
All overflow discharges into a common drain chamber at bottom.

The instrument monitors such properties as pH, hydrazine content, hardness, or phosphate content. Its use eliminates conventional manual testing where operator takes sample, allows it to cool, titrates it with colorimetric reagent or indicator, and makes comparison with standard color charts.

Readings are within a few parts per billion. Accuracy ranges from 2 to 5 percent.

Reported cost of instrument is less than $350.

(Chemalyzer analyzer is manufactured by Florida Instrument Co., Dept. PI, 1300 East Mermaid Lane, Philadelphia 18, Pennsylvania.)
Circle 9374 opposite covers.



Schematic diagram shows complete operation: As water sample flows into chamber at top, reagent is received in lower chamber. As soon as liquid in upper chamber reaches syphon top, entire chamber contents are discharged into chamber below, where reaction takes place. Reacted liquids are then syphoned into optical cell at bottom where results are viewed

Look! You guys with the

Low-Pressure Boilers

PICK'S GOT
a New Water Heater
JUST FOR YOU!

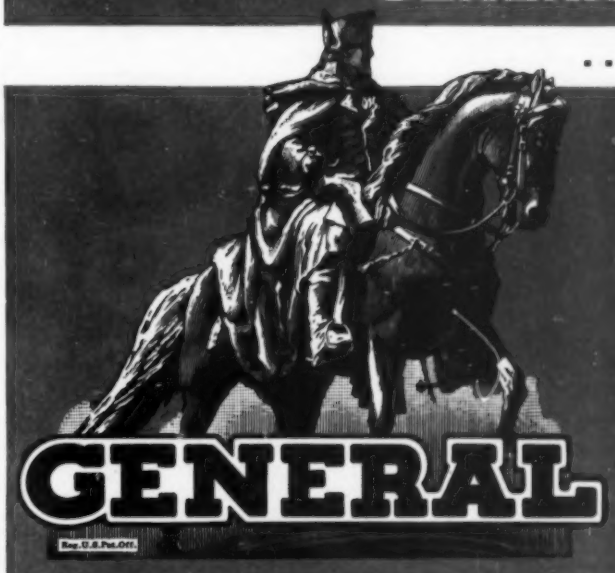
NO TUBES - NO TANKS - NO TROUBLE

DELIVERS HOT WATER
with the best temperature control you've ever had!

Get Facts - Write: Pick Manufacturing Co., West Bend 5, Wis.

Circle 9375 opposite covers.

GENERAL
... a trusted name in coal



For many decades, General Coal and its Associated Companies have successfully met the varied needs of all types of coal consumers. You can rely on this experience for all your coal requirements.

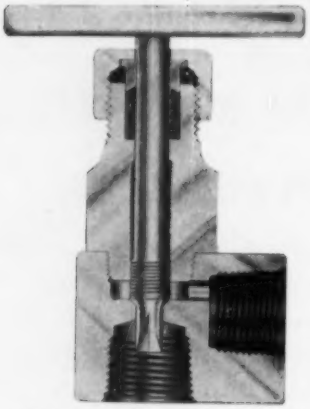
WESTMORELAND COAL COMPANY
HAMPTON COAL
STONEGA COKE & COAL COMPANY
GLENBROOK STONEGA RODA
DENDRON CROSSBROOK
JEDDO-HIGHLAND COAL COMPANY
Hazle Brook Premium Anthracite
GENCO ANTHRACITE & BITUMINOUS COALS

General Coal Company
123 SOUTH BROAD STREET, PHILADELPHIA 9, PA.
Branches:
Buffalo Charlotte, N.C. Cincinnati Cleveland Irwin, Pa. New York Norfolk

Circle 9377 opposite covers.

Valve's design concept improves flow control, reduces clogging chances

Using a tapered orifice principle, a line of bar stock valves are being manufactured in all standard sizes to one inch.



Bar stock valve works on tapered orifice principle to give good flow control and eliminate clogging problems

Pressure ratings are 3000 and 10,000 psi. Materials available are carbon steel, 303, 316, or 416 stainless steel, Alloy 20, Monel and aluminum.

VARIATION OF VALVE OPENING

A different concept in design gives improved flow control. By moving a plug with a tapered slot into and out of a circular opening, the flow of fluid or gas is controlled by the area of the slot at the head of opening. (See accompanying drawing).

Consequently, the valve will pass foreign particles up to 25 times larger than comparable valves.

As the stem moves in or out of the seat, a larger or smaller section of the slot is presented at the top of the opening. In this way, the orifice is varied for proper flow control.

("Veegroo" Tapered Orifice Valve is manufactured by General-American Valve Co., Dept. PI, Box 444, Corona del Mar, Calif.)
Circle 9378 opposite covers.

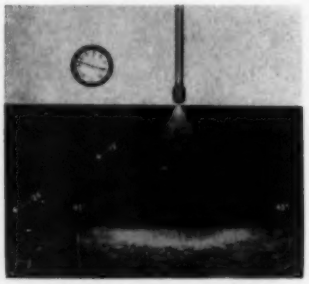
Spray nozzles discharge large quantities at low pressures

Producing medium to coarse, evenly distributed, solid-cone sprays with a normal spray angle of 70°, nozzles are designed to discharge large quantities of liquids at low pressures.

This pattern of distribution is applicable to scrubbing of fumes, cooling of gases, and gas washing operations.

Available in ten orifice sizes, the nozzles are hexagonal on the exterior and are stocked in bronze and stainless steel. However, they can be made of Everdur, Monel, or other corrosion-resistant materials on special order.

With water supplied at 10 psig, smallest nozzle will discharge 1.2 gpm and largest, 120 gpm. With pressure increased to 100 psig, the discharge rates are 3.75 and 375 gpm, respectively.



This ¾ inch nozzle with a 7.5 mm orifice is operating with water supplied at 20 psig

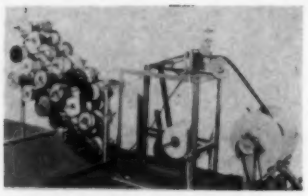
At the other extreme of the pressure scale, the nozzles will produce solid-cone sprays with uniform distribution at pressures as low as 3 psig.

(Fig. 627 spray nozzles are manufactured by Schutte and Koerting Company, Dept. PI, Cornwells Heights, Bucks County, Pa.)
Circle 9379 opposite covers.

A do-it-yourself cabling machine

Allowing any cable user to be a cable manufacturer, machine automatically assembles any type of cable on the spot as needed at speeds up to 900 ft an hour. It is designed to be used with manufacturer's types of cable jacketing.

In some cases, the machine will be supplied free to large volume users of the jacketing.



Machine allows user to assemble any type of cable on the spot

Tested under actual production conditions, easily operated machine eliminates expense of an extruder and permits instant fabrication of cables of up to 108 conductors and from ⅜" to 2½" in diam.

Method of operation is as follows: Spools of hook-up wire and jacketing are placed on racks. Correct number of wires is automatically fed into machine along with appropriate diameter jacket, which is supplied in flat form on reel.

Machine them wraps this jacketing around wire bundle, zips it shut and — if desired — permanently seals jacket.

Finished cable is fed onto a take-up reel, ready for immediate use, storage or shipment.

Self-contained unit consists of three parts — metal frame with enclosure head and sealer applicator mounted on top and a spindle to hold jacket reel underneath; pay-off unit with 36 eight-inch spindles of ¾" diameter shafts; power take-up and spool providing for a take-up reel to 24" diameter and power source to drive spool and pull cable through the machine.

(Cable machine is manufactured by The Zippertubing Company, Dept. PI, 752 South San Pedro St., Los Angeles 14, California.)
Circle 9380 opposite covers.

For coldroom applications where insulation weight may be problem

For insulating cold storage rooms and other installations where extreme lightness is a factor, an expanded-polystyrene insulation offers easy installation.

In addition, it has low conductivity — thermal conductivity is 0.23 at 10°F; 0.25 at 40°F; and 0.27 at 70°F. A cubic foot weighs only one pound — one man can put a sheet in place and hold it momentarily until adhesive grips.

Sheets come in large sizes. They cover more surface and reduce number of joints. Having strength and resilience, the material is not brittle and recovers quickly when pressed.

Completely inert, it will not rot, mould, or attract vermin. Moisture permeability average is 1.5 perm inches.

(J-Foam expanded polystyrene insulation is manufactured by Johns-Manville Corporation, Dept. PI, 22 East 40th St., New York 16, N.Y.)
Circle 9381 opposite covers.

Tube-piercing, tapping valves handle many refrigeration jobs

For refrigeration and air conditioning applications, a complete line of small tube-piercing and -tapping valves, including line tap, line port, can tap and control valves are offered for use with aluminum, copper or steel tubing.

The line tap and line port valves provide permanent-capped port for charging, discharging and testing. Line port valves are primarily for sealed systems. Control valves — both angle and two-way types — are designed for use with all these auxiliary valves and are provided with a screwdriver tip for easy operation. (See illustration.)

Essentially two valves em-

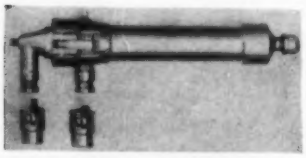
ployed together to pierce lines or cans, control valve is removable, leaving tap valves in place for further use. Control valve is easily removed without loss of gas or fluids.

Can tap valves screw directly onto containers and pierce the can seal to release refrigerant. Use of two-way control valve permits connection to gage and charging line in series to one or any number of containers simultaneously. This eliminates need for charging manifold.

(Tube-piercing and -tapping valves are manufactured by Henry Valve Co., Dept. PI, 3215 North Ave., Melrose Park, Ill.)
Circle 9382 opposite covers.

Line filter permits quick, easy cleaning

For such critical filtering applications as preventing nozzle plugging. eliminating rust and pipe scale, clarifying viscous liquids, and protecting hydraulic valves and flow-



No tools to remove screens

meters, filter has been developed to give fine filtration with Monel metal or 316 stainless steel screens.

Units are equipped with quick-couplers, on inlet, outlet, and body to enable an operator to quickly clean the filter element and use them again. No tools are required.

Filters have flanged easy removable screen and are non-short circuiting. The screens are made 20 to 700 mesh for pressures to 300 psig and temperatures to 450°F.

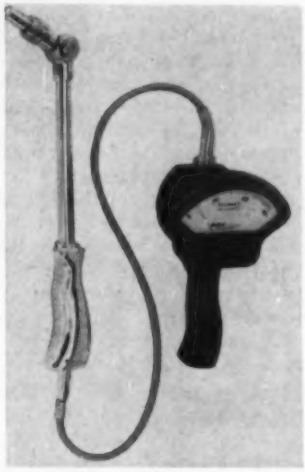
Units will withstand 150 psig differential pressures without a collapse.

(Quick-Coupling filters are manufactured by Ronnigen-Petter Co., Dept. PI, 330 So. 27th St., Vicksburg, Mich.)
Circle 9383 opposite covers.

Hand pyrometer measures surface temperatures

Requiring no power source, special tools or operator skill, portable hand pyrometer affords a simple method of measuring temperatures of various materials and surfaces.

It may be used anywhere for measuring temperatures of



Hand pyrometer requires no power source

convex, rotating or flat surfaces; for plastics, rubber or semi-fluids, liquids, gases or molten soft metals.

Accessories range from flexible or rigid-arm extensions to a variety of thermocouples. Two different carrying cases are available.

The pyrometer itself is offered in 12 scale ranges. All ranges are automatically compensated for changes in ambient temperature.

(Model B Hand Pyrometer is manufactured by West Instrument Corp., Dept. PI, 4363 Montrose Ave., Chicago, Ill.)
Circle 9384 opposite covers.

Tiny DC voltage supply eliminates batteries, standard cells

Stable DC voltage supply — actually small enough to hold in one hand — provides stable, calibrated DC voltage without use of standard cells or batteries.

Unit is designed to be used on potentiometer type recorders, bridge circuits, and in industrial measuring potentiometers.

Operating from a standard 115-volt AC power source, the instrument is essentially a two-stage voltage stabilizer plus a rectifier. First stage consists of a rectifier and voltage reference tube. Tube acts as a pre-stabilizer for second stage.

Stability is then± .05% for ±20% supply voltage variations; ±.08% maximum drift over 10,000 hours of operation (readjustable); ±.0015% maximum per degree Centigrade change in ambient temperature.

Standard output is one volt DC at 2 ma into a 500-ohm load. Other outputs are available.

(DC voltage supply is manufactured by The Hays Corp., Dept. PI, Michigan City, Ind.)
Circle 9385 opposite covers.

Ribbon . . .

. . . for temperature measurement and control applications to 500°F is furnished with pressure-sensitive tape for installation to flat, curved, or irregular surfaces. Flexible, less than .020 inch thick, the ribbon has resistance of 676 ohms at 25°C, varying at rate of 3.06 ohms per degree at 25°C. Calibration curve from −60°C to 260°C is furnished with each ribbon for quick conversion of resistance measurements to temperature.

(Model S6A Thermal-Ribbon is manufactured by Minco Products, Inc., 740 Washington Ave., Dept. PI, Minneapolis 1, Minn.)
Check 9386 on Reader Service Card.

Tells when air filters need cleaning

Gage tells when air filters are clogged and need replacement or cleaning. Two models are available — one is used in pressure range of 0.04″ to 0.15″ water column and will indicate an increase in pressure of 0.01″ at low end of range.

Other is used in 0.15″ to 1.0″ water column and will indicate increase in pressure

Gage tells when air filters are clogged

of 0.02″ at low end of range.

Operation at a specified pressure is obtained by adjusting a valve located in top brass fitting of gage. After being adjusted, this valve is locked into place by means of a set screw.

Gage will indicate either pressure or vacuum and can be supplied to indicate differential pressure.

This is how gage operates: When filters are new, a white ball stays below mark on indicating plastic tube. When filters build up too much resistance to operate efficiently, the ball moves above the mark indicating a new filter should be installed.

There are no liquid or working parts, other than the nylon ball.

(Air filter gage is manufactured by The Henry G. Dietz Company, Inc., Dept. PI, 12-16 Astoria Blvd., Long Island City, New York.)
Circle 9387 opposite covers.

NEW LITERATURE

plant services — power services maintenance

Reviews of books and industrial bulletins describing equipment, supplies, services

How to calculate best steam condenser job

Containing a number of basic formulas for calculation of condenser heat transfer coefficient, cooling water flow rate, condensing surface and other data, handbook offers simple method of calculating heating condenser performance.

All formulas are fully explained and illustrated with sample calculations.

Large part of handbook is made up of curves and charts on condenser performance, heat transfer correction data, absolute pressure limit data, pressure loss in water boxes, friction losses in brass tubes, and minimum capacities of air removal equipment.

It also includes air and water mixture data, logarithms to the base e and pressure-temperature conversion tables.

(Copies of Condenser Handbook are available on company letterhead request from C. H. Wheeler Mfg. Co., Dept. PI, 19th and Lehigh Ave., Philadelphia 32, Pa.)

Shows heavy-duty thermocouple

Manufactured with conductors encased in specially processed ceramics and surrounded by chemically clean metal sheaths, line of thermocouples have been designed for heavy-duty service.

Number of metal combinations are available — Copper-Constantan for temperatures down to −300°F and Rhodium-Platinum for temperatures over 1600°F.

Various junctions and tips are available.

(Data sheet B is available from Continental Sensing Inc., Dept. PI, 1950 N. Ruby St., Melrose Park, Ill.)
Circle 9388 opposite covers.

"Dry" fluid drive and couplings

Complete with product photographs and engineering drawings, 24-page bulletin describes expanded line of "dry" fluid drives and couplings.

Installation pictures show applications in broad cross-section of industry and explain how device solves many difficult drive problems.

Drives and couplings get their name from the fact that the "fluid" is heat-treated steel shot.

(Bulletin A-640B is issued by the Dodge Mfg. Corp., Dept. PI, Mishawaka, Ind.)
Circle 9389 opposite covers.

Illustrates operation of feedwater heaters

Six-page bulletin covers operations and features of baffle spray-type deaerating feedwater heaters.

Large cutaway drawing, with a step-by-step operating description, details operation of the heaters.

(Bul S-217 is issued by the Stickle Steam Specialties Co., Dept. PI, 2215 Valley Ave., Indianapolis 18, Ind.)
Circle 9390 opposite covers.

Reinforced polyester laminate

A grade of flexible glass-fiber reinforced polyester sheet bears a number of improvements in physical and electrical characteristics.

The data sheet is available and gives complete information on the laminate.

(Bul 123 is issued by Hays Manufacturing Co., Dept. PI, 801 West 12th St., Erie, Pa.)
Circle 9391 opposite covers.

Specifies transmitters for level measurement

Information on line of sealed-circuit force-balance differential pressure transmitters for level measurement is given in two-page specification sheet. Included are performance particulars, operational limits, working ranges, and design features.

(Spec. Sheet 13D1460 is issued by Fischer & Porter Co., Dept. PI, 764 Jacksonville Rd., Hatboro, Pa.)
Circle 9392 opposite covers.

How to test insulation

A wealth of information given in tables, charts and equations highlights 46-page publication entitled "Insulation Testing by DC Methods."

A three-page bibliography offers 77 sources of related information.

(Technical publication 22T1 is issued by James G. Biddle Co., Dept. PI, 1316 Arch St., Philadelphia 7, Pa.)
Circle 9393 opposite covers.

Pictures compressors and gas turbines

Thirty-eight pages of photographs, tables, dimensions, and drawings explain line of compressor in gas turbines.

Equipment covered includes: gas-engine-driven compressors, steam-engine-driven compressors, electric-motor-driven compressors, centrifugal compressors, axial flow compressors, expansion turbines, and engines.

(Bul 151 is issued by Clark Bros. Co., Div. of Dresser Operations, Inc., Dept. PI, Olean, New York.)
Circle 9394 opposite covers.

Automatic burner for oil, gas, both

Describing a completely redesigned automatic burner using gas, oil, or a combination, eight-page brochure gives complete details on all components.

Unit has completely interlocked sequence and safety circuits for automatic control of fuel and air.

(Bulletin 430B is issued by Peabody Engineering Corp., Dept. PI, 232 Madison Ave., New York 16, N.Y.)
Circle 9395 opposite covers.

Medium-pressure line of compressors

Four-page bulletin presents design and construction data as an aid to proper selection and application of line of medium-pressure compressors.

Units presented cover full range and capacities from 1000 to 12,000 cfm for pressures up to 15 psig. Seventeen sizes are listed.

(Bul LAH-158 is issued by Roots-Connersville Blower, Div. of Dresser Industries, Inc., Dept. PI, 900 West Mount St., Connersville, Ind.)
Circle 9396 opposite covers.

Specifies high-pressure reducing valve

For handling large ratio pressure reductions from 6000 psi upward to within 20% of initial pressure in one stage, high-pressure reducing valve is described in catalog sheet.

Valve is adapted for air, gas or hydraulic operation.

Instead of the usual spring, it employs a small air-reducing and relief valve for charging a diaphragm chamber as means of controlling reduced pressure.

Catalog sheet includes features, description, operating and ordering information as well as a drawing and photo of valve, parts list and dimensions.

(Fig. 198-R bulletin is issued by Atlas Valve Co., Dept. PI, 280 South St., Newark 5, New Jersey.)
Circle 9397 opposite covers.

Regulate draft
ACCORDING TO
BOILER REQUIREMENTS

Remote motor controller changes fan speed from full to 50% reduction

Select the exact amount of draft needed for optimum boiler performance with this 11-step controller for single phase motors.* This controller can be conveniently located anywhere in the boiler room. Provided as standard equipment with a DeBOTHEZAT Induced Draft Bifurcator Fans, the motor speed controller keeps draft in pace with fluctuating boiler loads to conserve fuel.

Space-saving Induced Draft Bifurcators, with 12" through 36" fan wheel diameters, are available for high pressure boilers delivering up to 60,000 pounds of steam per hour and low pressure boilers delivering up to 190,000 EDR.

**9-step controller for 3-phase motors also available.*

FOR FURTHER INFORMATION SEE OUR CATALOG IN SWEET'S PLANT ENGINEERING FILE OR WRITE FOR COPY

De Bothezat FANS

A DIVISION OF

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

IN CANADA: Represented by DOUGLAS ENGINEERING CO., Ltd., Toronto • Montreal

Circle 9398 opposite covers.

CUT HERE AND FILE

Nomographic Solution of Quadratic Equations

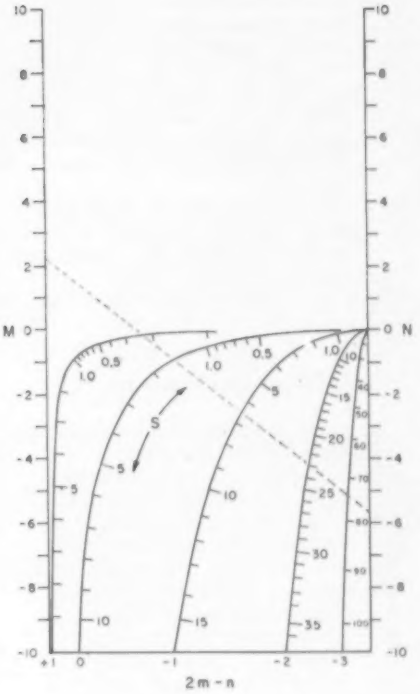
RONALD G. HARVEY
Sinclair Research Laboratories
Harvey, Ill.

Quadratics that appear in chemical equilibria and other equations can be solved quickly and accurately by means of accompanying nomograph which is based on following equation:

$$x^2 + (M)(10^m)(x) + (N)(10^n) = 0$$

where

$$x = (S)(10^m)$$



TYPICAL EXAMPLE

Solve the equation

$$x^2 + 2.2(10^{-10})x - 5.7(10^{-10}) = 0$$

Solution of this equation is found at point of intersection of dashed line from M = 2.2 to N = −5.7 and S curve for 2m−n = −2.

$$x = 23.0\ (10^{-10}) = 2.3\ (10^{-9})$$

Other examples are:

a) $x^2 - 5.7(10^{-2})x + 4.9(10^{-4}) = 0$
$2m\text{-}n = 0;\ x = +4.7(10^{-2})$ and $+1.05(10^{-2})$

b) $x^2 - 5.0(10^{-6})x - 5.0(10^{-14}) = 0$
$2m\text{-}n = -2;\ x = 25(10^{-8}) = 2.5(10^{-7})$

c) $x^2 + 5.0(10^{-6})x + 5.0(10^{-14}) = 0$
no positive real roots

Notes:

1. Graph (including approximations mentioned in note 2 below) gives all positive real roots of the quadratic equation. Negative and imaginary roots which have no significance in chemical equilibria problems, do not appear.
2. When 2m−n is greater than +1 or less than −3, solution lies close to one of the three axes. Significance of this is that one of three terms of the quadratic equation is negligible.

Appropriate solution is found as follows:

- For roots lying close to M axis, the approximation $x = -M(10^m)$ is valid
- For roots lying close to N axis, the approximation $x = (-N \times 10^n)^{1/2}$ is valid
- For roots lying close to horizontal axis, $x = (-N)\ (10^n)/(M)\ (10^m)$ is valid

Examples of this are:

d) $x^2 - 4(10^{-3})x - 7(10^{-6}) = 0$
$2m\text{-}n = +2;\ x = 4(10^{-3})$

e) $x^2 + 2(10^{-6})x - 3(10^{-11}) = 0$
$2m\text{-}n = -5;\ x = (3 \times 10^{-11})^{1/2} = 5.48(10^{-6})$

f) $x^2 + 4(10^{-6})x - 9(10^{-20}) = 0$
$2m\text{-}n = +4;\ x = +9(10^{-20})/4(10^{-6}) = 2.25(10^{-12})$

Fire-resistant clothing

Made of 100% cotton cloth which is given a permanent-type flameproofing, line of fire-resistant clothing is described in two-page folder.

Material combines soft feel of untreated cotton with flameproofing feature. It weighs approximately 11½ ounces per square yard finished.

Clothing can be laundered or dry-cleaned as many as ten times without loss of flameproofing properties.

Complete line of sleeves, cape sleeves, with and without bibs, regular and split leg aprons, overalls, coats, coveralls, hip leggings and pants are available.

(Folder S-7604 is available from American Optical Co., Safety Products Div., Dept. PI, Southbridge, Mass.)
Circle 9399 opposite covers.

Catalogs small motors

An AC shaded pole motor catalog features extensive information on unidirectional nongeared motors.

General information includes charts, diagrams and data on duty cycle, power sources, variations, braking, controls and explanations.

Five motor types are discussed.

(Cat U-1 is issued by Barber-Colman Co., Dept. PI, Rockford, Ill.)
Circle 9400 opposite covers.

All kinds of data on mercury lights

Eight pages of data describes complete line of mercury floodlights, rated from 100 to 1000 watts.

Application data, a discussion of mounting methods, dimension drawings, photometric data, and ordering information are included.

(Bul GEC-1486 is issued by General Electric Co., Dept. PI, One River Road, Schenectady 5, N. Y.)
Circle 9401 opposite covers.

How to melt snow

Describing an ice-melting material, one-page bulletin tells how material makes use of a rust inhibitor to reduce corrosion in areas where metal is present.

Material is recommended for melting ice and snow in virtually any location, including loading platforms, drives, walks and steps.

(Form 317 is issued by National Asphalt Corporation, Dept. PI, Bulkley Bldg., Cleveland 15, Ohio.)
Circle 9402 opposite covers.

Tells of hydrogen zeolite water softeners

Eight-page bulletin discusses hydrogen zeolite process, its chemistry, and variations in methods for neutralizing mineral acidity of hydrogen zeolite effluent.

Types of zeolites are discussed as well as relative advantages and disadvantages of various regenerants.

A brief description of decarbonators is included.

(Bul 4530-A is issued by Cochrane Corp., Dept. PI, Philadelphia 32, Pa.)
Circle 9403 opposite covers.

Catalogs automatic control for heating, ventilating

Fifty-page catalog fully describes and illustrates line of electric thermostats, pressure controls, humidistats, motor-operated valves, temperature regulators, motor operators, unit ventialtor controls, hot water controls, electronic controls, control center and accessories.

Operational and application data is incorporated with the description of each component. Devices are automatic controls for heating, ventilating, and air conditioning systems.

(Cat 26 is available from Barber-Colman Co., Dept. PI, 1300 Rock St., Rockford, Illinois.)
Circle 9404 opposite covers.

Data on industrial fans given in bulletin

Complete line of industrial fans is described in 16-page bulletin.

Temperature and altitude selection data, capacity tables, dimensions, special arrangements and special types of fans are listed.

Fans come in a variety of sizes with capacities ranging from 1000 to 30,000 cfm and static pressures from 2 to 15 inches.

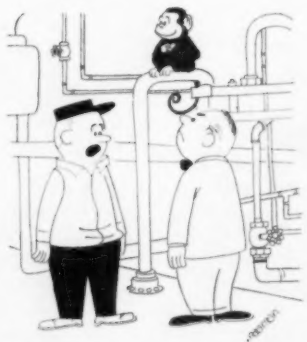
(Bul I-585 is issued by The Day Co., Dept. PI, 810 Third Ave., N. E., Minneapolis 13, Minnesota.)
Circle 9405 opposite covers.

Describes relief units for roofs

An automatic heat, smoke and explosion relief unit is fully explained with photographs and engineering specification information in four-page bulletin.

These units open automatically when fire or explosion occurs, venting smoke, heat, explosive forces up through roof instead of spreading them out across a building.

("Pyrojector" Bul is issued by The Swartwout Co., Dept. PI, 18511 Euclid Ave., Cleveland 13, Ohio.)
Circle 9406 opposite covers.



"I hope I can keep him. He seems perfectly happy here."

Describes gas engines for package compressors

Applications for high compression gas engines (200-700 hp) are detailed in two bulletins.

Bulletin 119 contains features, specifications, dimensions, rating curves and optional power take-off data on manufacturer's Superior 6G-510 engine. Illustrations of block, helical gear drive system, and engine action are included.

Bulletin 120 gives same information and similar photographs on six- and eight-cylinder engines.

(Copies of bulletins 119 and 120 are available from Customer Service Dept., White Diesel Engine Div., White Motor Co., Dept. PI, Springfield, Ohio.)
Circle 9407 opposite covers.

30,000-psi flowmeter

Two-page specification sheet describes a variable-area, armored flow meter with metal tube and non-indicating electronic transmission for high pressure applications up to 30,000 psi.

Materials of construction include stainless steel, Hastelloy B or C, and K-Monel.

Maximum recommended temperature is 650°F.

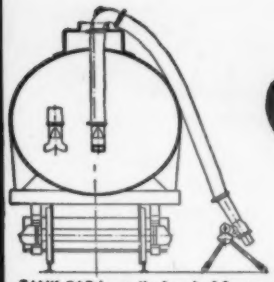
(Bul 10A1159 is issued by the Fischer & Porter Co., Dept. PI, 817 Jacksonville Road, Hatboro, Pa.)
Circle 9408 opposite covers.

Compact temperature, pressure controllers

Available in three temperature and four pressure ranges for stock delivery, line of compact controllers are announced in two-page bulletin.

Full specifications, inside view and line drawing showing its applications are included.

(Bulletin 370-1 is issued by The Powers Regulator Co., Dept. PI, 3434 Oakton St., Skokie, Ill.)
Circle 9409 opposite covers.



TANK CAR is easily freed of fumes for workers' safety.

CHEMICAL STILL is here ventilated while being repaired.

KEEP AIR FRESH

in confined places with COPPUS *Design "A" Ventilator*

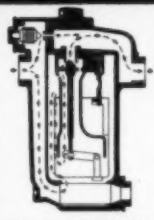
Improve workers' safety—health—comfort—efficiency. Get rid of dangerous gases, fumes, stagnant air. Coppus Design "A" Ventilator ventilates tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments, fuselages. For complete information, write Coppus Engineering Corporation, 181 Park Ave., Worcester 2, Mass. Sales Offices in *Thomas' Register.*

Other "Blue Ribbon" Products in *Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory* and *Mining Catalogs.*

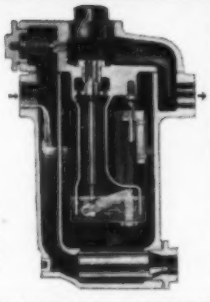
ANOTHER COPPUS "BLUE RIBBON" PRODUCT

Circle 9410 opposite covers.

Now—A Steam Trap that Adjusts Automatically to Every Operating Condition!



Warm-up speeded by discharge through by-pass as well as main orifice.



In-line installation. All parts serviced without removing body from line.

AUTOMATICALLY REGULATES FOR FASTER WARM-UP AND TO KEEP OPERATING TEMPERATURE AT PEAK HEAT

Proven bucket design with built-in accessories. By-pass thermostat increases discharge for warm-up and overload conditions. Thermostat compensated to operate at 10° below saturated steam temp. Wright-Austin Airxpel principle provides for mechanical discharge of air after Thermostatic by-pass has closed.

WRITE FOR BULLETIN 808

WRIGHT-AUSTIN COMPANY

3245 WIGHT STREET • DETROIT 7, MICH.

Circle 9411 opposite covers.

NEW LITERATURE

Longer life for V belts

Containing many case histories, 12-page illustrated manual, entitled "How to Get Longer Life from V-Belt Drives", gives many cost-saving tips.

Manual tells how to select and install V belts, how to detect V-belt trouble, diagnose belt failures, and correct drive troubles.

List of valuable tips for proper V-belt maintenance is included as well as a suggested inventory survey check list for V-belt drives.

(Catalog #IP-1577 is issued by B. F. Goodrich Industrial Products Co., Dept. PI, Akron, Ohio.)

Circle 9412 opposite covers.

Lots of ideas on use of slotted steel angle

A hot dip galvanized angle in 12 and 14 gauge weights and 10- and 12-foot lengths has holes spaced so that it may be cut to any length and bolted together.

Booklet of 32 pages gives many ideas how this constructual frame may be used to make such items as storage racks, tables, guards, frames, carts, stands, derricks, and ladders.

(Idea Book #299 is issued by Equipto, Dept. PI, Aurora, Illinois.)

Circle 9413 opposite covers.

Specifies gages and valves

Eight-page catalog gives complete story on line of standard gages and valves.

Illustrated with photographs and drawings, catalog also includes pressure-temperature graphs and ratings, table of sizes, specifications, and descriptions of materials and construction features.

(Cat #335 is issued by Jerguson Gage & Valve Co., Dept. PI, 80 Adams St., Burlington, Mass.)

Circle 9414 opposite covers.

NEW USG "A" LINE INDUSTRIAL PRESSURE GAUGES

WHEN YOU SEE THESE GAUGES, YOU WON'T BELIEVE THE LOW PRICES!

Grade A accuracy . . . quality features at prices up to 40% below premium lines

It will pay you to check specifications of USG's new "A" Line for your plant applications—principally where steam, water and oil pressures must be indicated. Here are the highlights:

- **MEETS A.S.A. GRADE A STANDARDS** — Guaranteed accurate within 1% of scale for middle (working) half of scale—1½% for remainder.
- **WIDE CHOICE OF OPTIONS** — Variety of cases (aluminum standard), mountings, movements, Bourdon tubes . . . dial sizes 3½ to 12 inches . . . pressures to 10,000 psi.
- **LONG LIFE AND EASY MAINTENANCE**— Built-in features and rugged construction assure maximum life with minimum maintenance.

Find Your Nearest Distributor in the "Yellow Pages"

You'll have to see the new "A" Line gauges to believe all the quality features and options offered at amazingly low costs. Ask your U.S. Gauge distributor for a demonstration today, or write for a copy of new Catalog 305.

UNITED STATES GAUGE USG

DIVISION OF AMERICAN MACHINE AND METALS, INC., SELLERSVILLE, PA.

Circle 9376 opposite covers.

the 2569 **MURPHY**

SEPARATOR

does a smooth job of

SEPARATING and EJECTING

water, oil, scale, and rust from

COMPRESSED AIR LINES

YOU SHOULD HAVE FULL INFORMATION

Write now for FREE Data Sheet No. 2569

JAMCO

JAS. A. MURPHY & CO., INC.

1419 EAST HIGH STREET, HAMILTON, OHIO

Circle 9415 opposite covers.

Radiant heaters

Illustrating typical "spot-heating" as well as large area heating problems, four-page bulletin tells how they may be solved with radiant heaters.

Both ceiling type and angular-mounted models are discussed.

Also included are controls such as input controller by which individual heater radiation may be precisely controlled to individuals' personal heat requirements; room thermostats which maintain preset comfort levels when a number of heaters are used; and magnetic contactors which allow controls to be used on higher ratings.

Simple guide for selecting heaters and controls is presented.

(Bul F-1614 is issued by Edwin L. Wiegand Co., Dept. PI, 7500 Thomas Blvd., Pittsburgh 8, Pa.)
Circle 9416 opposite covers.

Stainless steel valves

Wealth of information on stainless steel valves for corrosive services includes data on standards, methods of rating, materials of construction, and alloy compositions.

Bulletin includes design details, illustrates 36 basic valves, and describes 40 of their variations.

(Bulletin #7 is issued by the Alloy Steel Products Co. Inc., Dept. PI, Linden, N. J.)
Circle 9417 opposite covers.

Easily cleans surfaces

Four-page bulletin describes a "pistol" for de-rusting, cleaning, and de-scaling surfaces.

Cleaning is accomplished by means of a set of rapidly reciprocating steel needles striking the surface. The tool operates on normal air pressure at not more than 90 psi.

(Von Arx-Pistol Bul is issued by The Marindus Co., Dept. PI, 52 Wall St., New York 5, N. Y.)
Circle 9418 opposite covers.

Speeds up unloading of frozen materials

For thawing frozen bulk material in railroad cars, 20-page booklet describes how to use line of infra-red heating equipment.

Photographs of numerous installations, plus case histories, are given.

In addition, booklet presents a technical description of infra-red heat rays and explains how they can be harnessed to speed up unloading of materials in freezing weather.

(Bulletin 168 is issued by Hewitt-Robbins, Inc., Dept. PI, 666 Glenbrook Rd., Stamford, Conn.)
Circle 9419 opposite covers.

Flasher warning unit specs given

Four-page specification sheet gives specifications for flasher units to be used with indicator lights. Two models are shown — a completely transistorized one and one qualified by military specifications.

(Buls 399-100 and 396-100 are issued by Master Specialties Co., Dept. PI, 956 East 108th St., Los Angeles 59, California.)
Circle 9420 opposite covers.

Axial flow fans provide high air displacement

Providing high air displacement and pressure for cooling, heating, and ventilating, line of axial flow fans is described in four-page bulletin.

Suggested applications are listed, together with table of electric motor specifications for 27-v DC, 400 and 60-cycle AC, and special models.

Characteristics as capacity, static pressure, rotor tip diameter, nominal hp, speed and weight are listed.

(Bulletin No. 5802 is issued by Pesco Products Division, Borg-Warner Corporation, Dept. PI, Bedford, Ohio.)
Circle 9421 opposite covers.

All about skylights

Twelve-page catalog contains up-to-date information on complete line of aluminum and fiberglass skylight products.

All models and designs — as well as major installations — are described and illustrated. Cutaway drawings explain all features.

(AIA File #12-J is issued by The Marco Co., Dept. PI, 45 Greenwood Ave., East Orange, New Jersey.)
Circle 9422 opposite covers.

Mechanical power transmissions

Complete line of sheaves, variable-pitch sheaves, V-belts, flat-belt pulleys, pillow blocks, flange units, take-up bearings, couplings and timing-belt drives are covered in 8-page bulletin.

All units are clearly pictured and described. All sizes are given in easy-to-read chart form.

(Bulletin 3101 is issued by T. B. Wood's Sons Co., Dept. PI, Chambersburg, Pa.)
Circle 9423 opposite covers.

Controls cranes

Describing in detail the components, enclosures available, and applications, four-page bulletin gives full details on control for light industrial AC cab and floor-operated cranes.

All components are illustrated.

(Bulletin 6431 is issued by The Electric Controller & Mfg. Co., division of Square D Co., Dept. PI, 4500 Lee Rd., Cleveland 28, Ohio.)
Circle 9424 opposite covers.

For more information on items reported in the New Literature section circle corresponding numbers on reader service card opposite inside covers.

Liquid level control has no floats

Eighteen-page catalog describes system of level control which operates without floats and no moving part in the liquid.

Subjects covered include liquid level relays, electrodes, signals, alarms, and alternators.

Charts and diagrams of a typical application are presented.

(Liquid level control bulletin is issued by B/W Controller Corp., Dept. PI, 2200 E. Maple Road, Birmingham, Michigan.)
Circle 9425 opposite covers.

Compact boiler specified

Complete specifications and schematics on line of compact boilers are given in four-page, two-color publication.

These boilers are rated at 150 boiler hp and occupy only 40 sq ft.

Boilers are oil, gas or combination of both and are available in six sizes for 20 to 200 hp.

(Bul 475 is issued by Vapor Heating Corp., Dept. PI, 6420 W. Howard St., Chicago 31, Illinois.)
Circle 9426 opposite covers.

Gives performance date on conductors

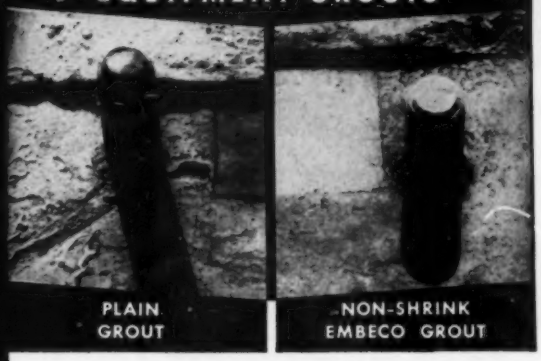
Drawn up as a guide to selecting hard drawn copper or aluminum outer conductor transmission lines, bulletin contains complete lists and descriptions of connectors, supporting hardware and other accessories for transmission assemblies.

In addition full performance data, curves and charts are given.

Included are 7/8", 1 5/8", 3 1/8", and 6 1/8" 50-ohm transmission lines and 6 1/8" 75-ohm lines.

(Bulletin 589 is issued by Prodelin Inc., Dept. V-2, 307 Bergen Ave., Kearny, N. J.)
Circle 9427 opposite covers.

COMPARE
EQUIPMENT GROUTS



. . . And You'll See Why

EMBECO PRE-MIXED GROUT

gives *lasting* results on every equipment grouting job. Add only water to Embeco Pre-Mixed Grout, mix and place. Obtain a *flowable, non-shrink* grout that insures full bedplate contact, maintains alignment, has high impact resistance.

Write for Free Grouting Guide

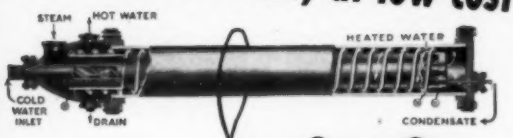
DIVISION OF AMERICAN-MARIETTA COMPANY

the MASTER BUILDERS co.

CLEVELAND 3, OHIO TORONTO 9, ONTARIO

Circle 9428 opposite covers.

STEAMLINED!
to heat water fast, at low cost



In the Johnson Heater, water to be heated is routed first inside, then outside, a blanket of live steam. It's full pressure steam, too; up to 150 lbs., or 250 lbs. in heavy duty types, no reducers are needed. The result: faster, more efficient heat transfer for a unit of its size. No wonder industry has found so many applications for the Johnson "Instant" Heater, in heating water and process liquids of various types.

Sizes for all needs; write for literature

The Johnson Corporation

807 Wood St., Three Rivers, Mich.

Circle 9429 opposite covers.

Turbine Control

From page 13

operation adjusts to the normal space.

A final aspect of this operation that merits attention as yet another unusual factor concerns the river pumps, about a half mile from the power station. The pumps are driven by 4160-volt motors. When in operation the pumps pass circulating water from the river to the filtering pond where the water is transferred to the condenser and lubricating oil cooler by another set of pumps.

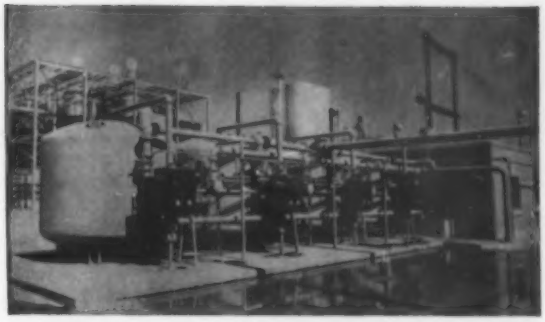
But since the power that operates the pumps emanates solely from the turbine generator, they can be started up only after the generator is actually in operation. Consequently, the turbine may have to start up at very low vacuum conditions, including conditions of atmospheric exhaust, until the pumps can be put into service.

How long these low vacuum start-up conditions last will depend upon the operator, some start-up periods lasting as high as an hour and a half. This situation can be mitigated to a small extent by water supplies for the cooling system coming from the Thurso city water system. However, because of low pressure this water supply cannot be relied upon and at best it can be counted on only in a minor way in the overall operation plan.

(Turbine and control system was designed and manufactured by De Laval Steam Turbine Company, Dept. PI, Trenton, N. J., in cooperation with Combustion Engineering Superheater Company, Ltd., Montreal and Foundation of Canada Engineering Corp.)

Circle 9430 opposite covers.

"Oh, . . . ya load sixteen ton and what'ya get . . ."



BOILER FEEDWATER TREATMENT

(for over half a century)

Complete plants for water softening, demineralization, silica removal, de-oiling of condensate, clarification, de-alkalizing and all other requirements.

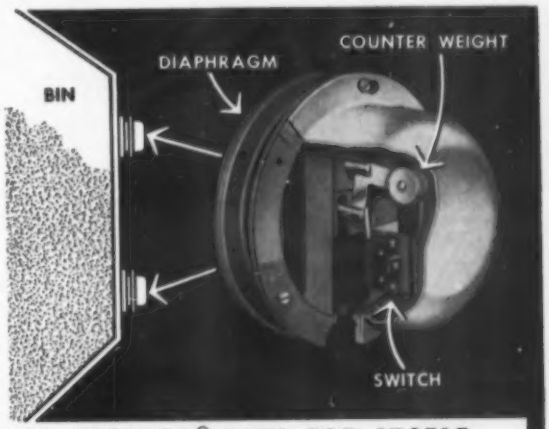
Send for Bulletin BFT-11 or Nearest Field Representative.

H&T SERVICE

HUNGERFORD & TERRY, INC.

CLAYTON 1, NEW JERSEY

Circle 9431 opposite covers.



BIN-DICATOR® PAYS FOR ITSELF FIRST TIME IT PREVENTS BIN OVERFLOW, CONVEYOR CLOG, ELEVATOR CHOKE-UP, MACHINERY DAMAGE, REPAIR SHUT-DOWN

If you handle bulk material you probably need Bin-Dicators. The nominal cost of this protection and automatic control makes it the lowest-cost modernization you can buy. Available with Explosion-Proof Switch.

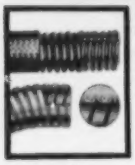
THE BIN-DICATOR CO. *Write for free copy of catalog BD-15 or call*

13946-V2 Kercheval • Detroit 15, Mich. VAlley 2-4932

WE SELL DIRECT • PHONE ORDERS COLLECT

Circle 9432 opposite covers.

Custom constructed assemblies for industrial power systems



All sizes in bronze, stainless or carbon steel, monel, inconel and low carbon nickel. Seamless spiral or parallel corrugation... Braided. All type of fittings and flanges welded, brazed or soldered. Also, interlocked hose.

write — wire — phone: RE 7-3311
...for prices and catalogs

COBRA METAL HOSE

5059 S. Kedzie Ave. • Chicago 32, Ill.

Circle 9433 opposite covers.

How To Get Things Done Better And Faster

BOARDMASTER VISUAL CONTROL

- ★ Gives Graphic Picture — Saves Time, Saves Money, Prevents Errors
- ★ Simple to operate — Type or Write on Cards, Snap in Grooves
- ★ Ideal for Production, Traffic, Inventory, Scheduling, Sales, Etc.
- ★ Made of Metal Compact and Attractive. Over 300,000 in Use

Full price $49.50 with cards

FREE 24-PAGE BOOKLET NO. P-30 Without Obligation

Write for Your Copy Today

GRAPHIC SYSTEMS

55 West 42nd St. • New York 36, N. Y.

Circle 9434 opposite covers.

Nudear Power

From page 15

paying over half the capital costs; in others, a substantial part of the cost is being charged to research or shared by a number of interested companies.

In others, the principal subsidy appears to be in the form of an understanding with the state public utility commissions that, in the interest of promoting progress, the company will be permitted to charge rates high enough to insure a fair return on the heavy investment required.

Some of them may also have indirect subsidies in the price they pay for uranium or other fuels, in arrangements for processing the spent fuel, for atomic waste disposal, or for insurance.

I want to make clear that I am not objecting to the government, the public utility commissions, or the companies making these arrangements to speed up this important development.

It is a real tribute to the progressive drive of America — *but I do think we have been misled into thinking that these proposed plants are expected to be commercially competitive or nearly so.*

However, I would object to building many more such subsidized plants until we have much more experience and some new and better ideas.

Between ten and twenty-five years from now (the timing depending partly on technological developments and partly on the relative price trends of competitive fuels) a moderate, but increasing proportion of the larger commercial power plants utilizing atomic fuels may well be built without subsidy.

However, no existing plants of reasonable efficiency would be shut down or converted to atomic fuel, and the principal effect on the public utility industry will be higher capital requirements, hopefully offset by somewhat lower fuel costs.

The general belief is that when and as nuclear power becomes economical, it will fit into the nation's growing integrated power systems without displacing then-existing generating facilities or preventing the construction in favorable areas of hydro and conventional steam power plants.

Different Objectives in Britain

In view of recent charges that Britain is ahead of us in developing atomic power, it should be pointed out that the objectives of the two countries are quite different. Britain's existing plants are essentially plutonium-producing piles or reactors modified to get some by-product power, but even on this basis the power is not cheap by American standards although it does cut Britain's foreign exchange needs.

The main American effort is properly directed toward the development of various possible methods of ultimately getting power at reasonable cost, rather than engaging in a race to install kilowatt capacity regardless of cost — though many in Congress seem to think that we should build more plants, regardless of cost, and have the taxpayers pay the difference.

The latest United States plants making U-235 from natural uranium by the diffusion process buy their tremendous requirements of power from conventional plants burning coal, which are among the lowest-cost in the world.

If reactors based on the present state of the art were built to produce the power for these plants, the result would be to greatly increase the cost of the U-235 produced. This increased cost would in turn increase the cost of nuclear power obtained by the use of enriched uranium in reactors.

Similarly, by-product power produced from present reactors designed to produce plutonium would be relatively expensive and would be generated in areas where conventional power is relatively cheap.

An enlightening statement on atomic power costs by a man in a position to judge was made by Major General Nichols (Ret.), former General Manager of the Atomic Energy Commission.

He said that no power plant even on the drawing boards can compete with the four-mill power available in some areas today, and that the prospective cost, even on a favorable accounting basis, is more likely to be 8 to 12 mills.

In my opinion, the price of coal will be the principal determinant as to when atomic energy will be generally competitive.

In central power station generation, which represents the most rapidly growing demand for fuel, coal should handle a large share of the rapid growth in U. S. demand for a good many years to come. This assumes that the coal industry will be able to hold down its costs through technological improvements.

In my opinion, the decrease in the percentage of power production obtained from natural gas, oil, and waterpower will be greater than the percentage which atomic energy is likely to take up in the next 25 years. So, coal will probably be taking care of a slightly increasing percentage of a rapidly increasing demand.

While atomic energy will doubtless supply some new markets, especially abroad, which coal might otherwise have cared for, I foresee for at least two decades a substantial and continuing recovery in the demand for United States coal. ■

Power System

From page 19

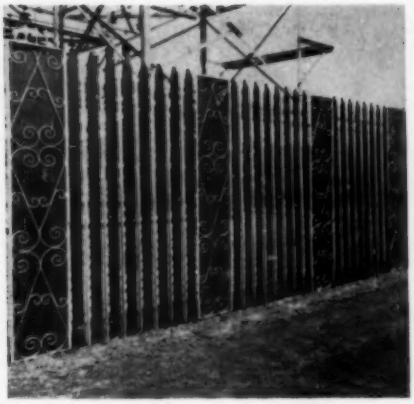
ficient spread of incandescent fixtures to provide emergency lighting during interruption and through the delayed start-up period of mercury-vapor units.

Power-Factor Improvement

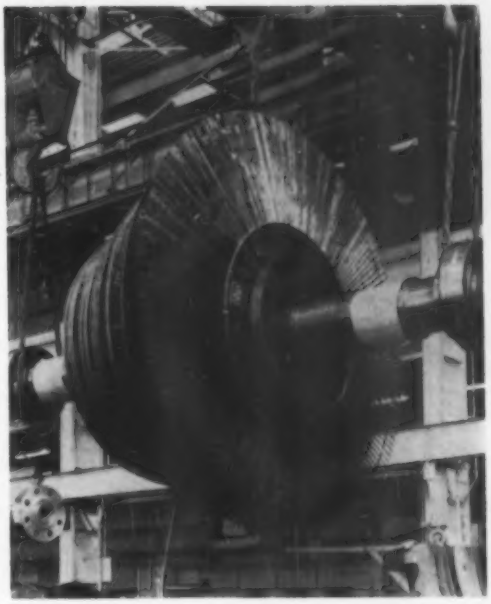
The ultimate need for power-factor improvement by capacitors was foreseen and provided for in spare circuit breaker positions at the unit substations. Application was

To page 34

PHOTO NEWS



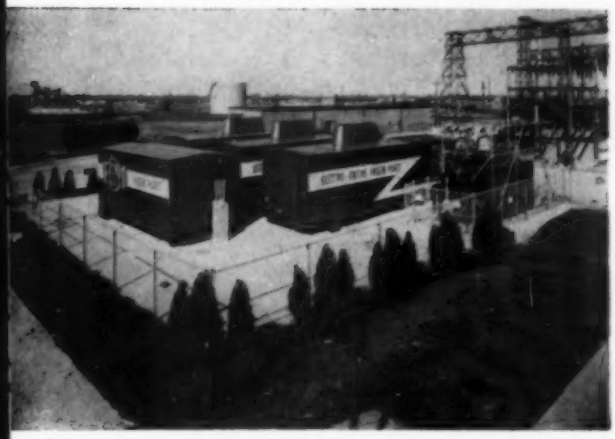
PRETTY AS A PICTURE — without large outlays for landscaping and maintenance — can be applied to substations using these decorative aluminum enclosures (left) as contrasted with usual fencing (right). The maintenance-free enclosures are being introduced by Joslyn Mfg. & Supply Company, Cleveland, Ohio.



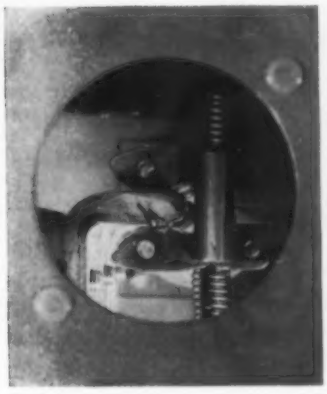
PASSING THE "CRITICAL PRESSURE" BARRIER, the Philadelphia Electric Company's Eddystone plant will use a turbine supply pressure of 5000 psig. Pictured is the first of two sections of the huge low-pressure bladed spindle for the 325,000-kw cross-compounded superpressure unit before undergoing operating temperature test at Westinghouse. Containing blades 44 inches long, the spindle has an over-all diameter of 14½ feet.

FOR LOW-COST PEAKING, a 6000-kw power plant can be easily added to base-load units. Consisting of three 2000-kw diesel generating units (each in its own steel, weather-proofed, sound-deadening housing) and one control unit, the plant is designed for completely automatic and remote control. It can be brought on line, with all three generators at full load and synchronized, within 90 seconds to supply power for handling peak loads. Each generating unit can be shipped on standard 40-foot flat car and transferred to a low-boy trailer for hauling to installation site.

(MU-60 power plant is manufactured by Electro-Motive Division, General Motors, Dept. PI, La Grange, Ill.)
Check 9435 on Reader Service Card.



GIANT, ECONOMY SIZE PACKAGE — largest boiler ever to be moved intact — accounted for a $200,000 savings for the Hanford Atomic Products Operation, Richland, Wash. Actually the 90,000 lb/hr boiler is not a packaged unit. It was moved 26 miles from one company location to another. By moving it with all fixtures attached, cost of dismantling and re-erecting was eliminated.



IT'S AN OPEN AND SHUT CASE — you can see what's happening in these low-voltage circuit breakers. As an added safety precaution, visual inspection of breaker contacts has been provided with recently introduced models. Openings with transparent covers on sides of enclosures allow operator to see disconnect contacts.

(U-Re-Lite circuit breakers are manufactured by I-T-E Circuit Breaker Company, Dept. PI, 1900 Hamilton St., Philadelphia 30, Pa.)
Check 9436 on Reader Service Card.

Power System

From page 32

deferred until operating experience indicates the required capacitor rating at each location.

The Future

Plans for succeeding stages of the program are indefinite as to sequence and detail. However, expansion is expected and "planning ahead" was the keynote of this first move. Whatever future requirements may be, the extreme flexibility of this type of electrical system coupled with provisions already made ensures adequate capacity will be available when it is needed.

This entire project was planned and supervised by the Reading Tube Corporation's own staff of engineers. The M. H. Treadwell Company designed and installed the casting equipment; General Electric application engineers assisted in design of the power system, application of rectifiers and other utilization equipment. Preliminary planning by all parties spanned many months, and final details were subjected to careful review to ensure the realization of an outstanding electrical installation — economical in cost, and adequate for any future demand. ■

Steam Trap Maintenance

From page 11

completely replaced when faulty.

The remaining 15,000 are mostly inverted bucket types used on high and low pressure steam mains, building pre-heaters, and tanks.

A special field department services about 10,000 of these traps each year, 1000 of them completely in the field. For this work, six men are assigned solely to carry out steam trap maintenance. Duties of four include removal, reinstallation and general field cleaning, while another crew member transports those traps needing repair to the machine department with a pick-up truck.

The sixth man on the team covers trouble calls and inspection of outside steam lines, beside laying out and coordinating work of the crew.

Parts are in stock for every make of trap in use, so that there is rarely delay in getting a trap back into operation.

The inspection of traps and valves on the outside high and low pressure steam mains is performed on a weekly schedule in the winter, and on an average of twice per month, as time permits, in the warmer months. When trouble is detected during these inspections, immediate repairs are made if at all possible. Otherwise, the repair is delayed until the line can be conveniently shut down.

The maintenance crew has found that the main cause of steam trap failure and replacement is improper selection and installation. When the standard practices are followed explicitly by engineers and the installing mechanics, breakdown and replacements become appreciably less.

A dramatic instance of this kind of failure occurred several years ago. At that time, twelve ball-float traps were installed beyond their capacity. The rapid action of the ball-float valve knocked holes in all twelve traps, which blew their tops all at once. Needless to say, a considerable amount of steam escaped before the lines could be shut down.

Since its start in 1928, the Kodak Park steam trap maintenance program has proved its value in reducing costs by keeping all traps in good repair.

Before then, there was no specialized crew for the work, and traps were repaired on a "trouble call" basis. Now, when a new trap is installed, or any of the old ones replaced, removed or switched to a new location, the servicing department is immediately notified.

Thus, the location and specifications of every trap are accurately known and maintenance can be carried on systematically. ■

advertisers' index

A

Allied Metal Hose Co. 8
Armstrong Machine Works 19

B

Barksdale Valves ..... 4th Cover
Bin-Dicator Co., The 31
Boiler Tube Company of America 22

C

Cobra Metal Hose 32
Coppus Engineering Corporation 29
Crane Co. ..... 2nd Cover

D

DeBothezat Fans Division, American Machine & Metals, Inc. 27

E

Elliott Company, Roto Plant 10

G

General Coal Company 23
Graphic Systems 32

H

Henszey Company 8
Hungerford & Terry, Inc. 31

I

Ideal Industries 10

J

Johnson Corporation, The 31

M

Master Builders Co., The, Division of American-Marietta Company 31
Morton Salt Company ..... 3rd Cover
Murphy & Co., Inc., Jas. A. 29

O

Onan & Sons Inc., D. W. 5

P

Peabody Engineering Corporation 4
Pick Manufacturing Co. 23
Putman Publishing Company 22

S

Schaub Engineering Company, Fred H. .. 6

U

United Electric Coal Companies, The 7
United States Gauge, Division of American Machine and Metals, Inc. 29

W

Wickes Boiler Co., Division of the Wickes Corporation 9
Wright-Austin Company 29

Y

Yarnall-Waring Co. 21

Advertising Representatives

RICHARD H. PUTMAN — Sales Manager
FRED S. BRANDT — Eastern Sales Manager

CHICAGO 11, ILLINOIS, Richard H. Putman, 111 East Delaware Place, WHitehall 4-6141

LOS ANGELES 57, CALIFORNIA, Bob Wettstein & Associates, Walter P. Greenwood, 672 S. Lafayette Park Place, DUnkirk 8-2286

NEW YORK 17, NEW YORK, Fred S. Brandt, William J. Probovich, 369 Lexington Avenue, MUrray Hill 6-7738

PORTLAND 5, OREGON, Bob Wettstein & Associates, 337 Pittock Block, 921 SW Washington St., CApitol 8-4107

SAN FRANCISCO 8, CALIFORNIA, Bob Wettstein & Associates, Jerry Nowell, Gene Watts, 355 Stockton St., YUkon 2-9537

SOUTHEASTERN STATES, Joe H. Howell, 40 Peachtree Place, N.W., Atlanta 9, Georgia, TRinity 2-2235

THAT'S INTERESTING

Cut-off switch controls reactor

Bendix Aviation Corporation announces new electronic cut-off switch for controlling nuclear reactors.

Equipment detects and warns of abnormal conditions, and automatically shuts down if safety requires.

Comprising more than 100 transistors, the unit is smaller than your home refrigerator.

How wet the snow

A new device for measuring the water content of mountain snowpacks is being installed in California's rugged Sierra Nevada mountains. The system developed by the U.S. Army Corps of Engineers and Sierra Electronic Corporation will be placed in operation this winter.

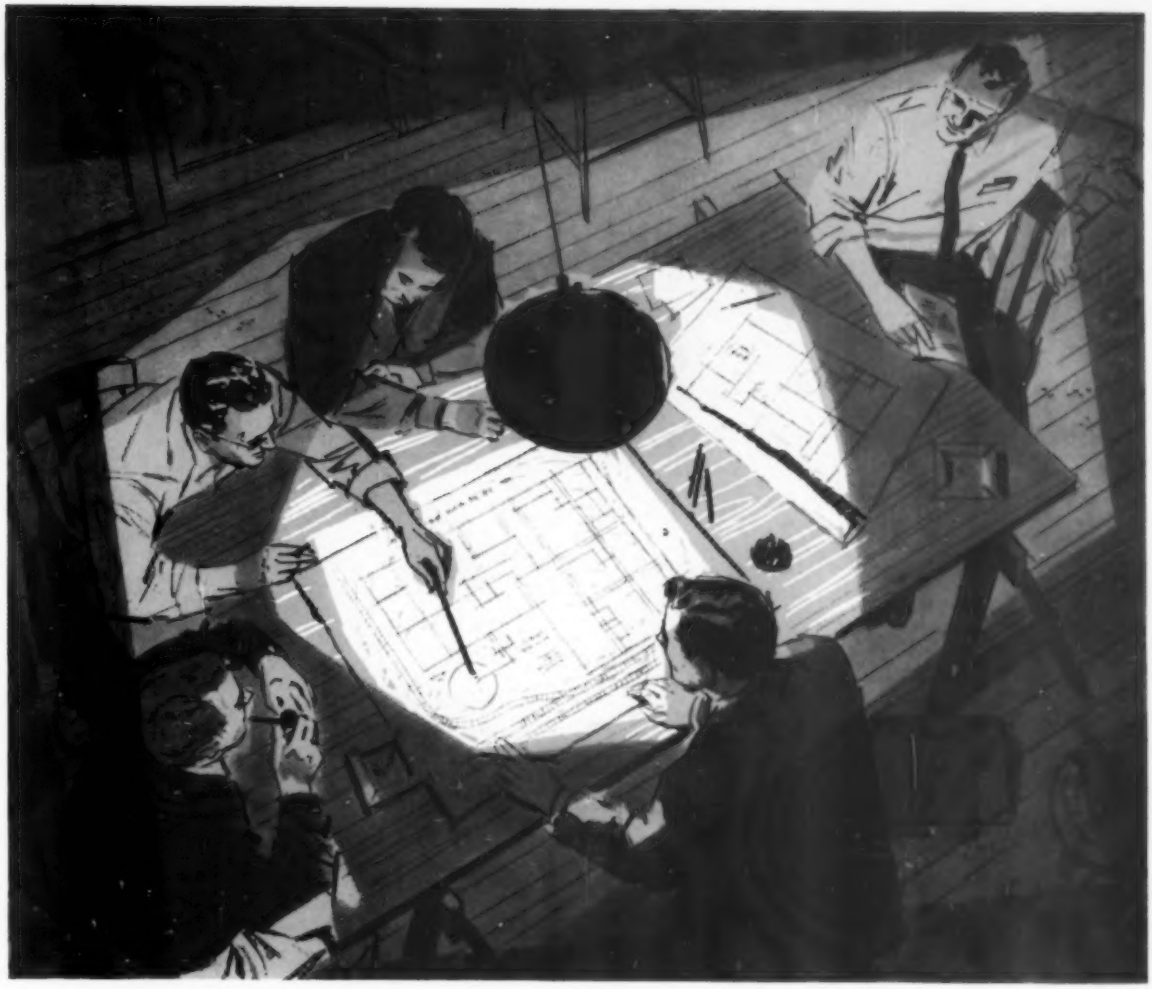
The snow gauging equipment, based on radiation detector of the scintillation type, enables engineers to obtain accurate water content of snow in remote areas.

This information will be a great help in the planning and operating irrigation projects, flood control programs and hydro-electric plants.

Millions of dollars can be saved in the design and construction of flood control and water conservation facilities by obtaining frequent and accurate hydrological reports, which, until now, were almost impossible to obtain.

Fiberglass heat, light controls

Providing light for storage areas, Filon Plastics Corporation has manufactured reinforced plastic panels. Attractive and blending with corrugated metal walls, weather-resistant panels are available in multiple colors, weights and configurations. Color controls amount of light and heat entering a building.



We can give you valuable help

In designing, installing or converting water softening equipment

There's no charge for the services of one of Morton's Consulting Engineers at any stage of your work with water softening systems. Many architects and engineers have already found that calling in a Morton man can save time and work and will result in water softening installations that provide maximum efficiency and the greatest economy of operation.

The Morton Consulting Engineers have experience with all types of water softening systems for all types of uses. The assistance they offer is well worth an inquiry. If you think a Morton Consulting Engineer could be of assistance to you, just send in the coupon today.

I would like to know how a Morton Consulting Engineer could help me_____

I understand there is no charge for this service.

Name_____

Title_____

Company_____

Address_____

City_____ Zone___ State_____

MORTON SALT COMPANY

INDUSTRIAL DIVISION

Dept. PI 159, 110 No. Wacker Drive, Chicago 6, Illinois

Circle 9437 opposite covers.

HERE'S HOW YOU CAN SAVE MONEY ON PRESSURE SWITCHES FOR YOUR SPECIAL REQUIREMENTS...

For sensing pressure differences of .45 to 80 inches of water vacuum or pressure.
For extreme accuracy, single and dual setting switches in the working range of 30 inches of mercury vacuum to 100 P.S.I. pressure. Housed models.
For mounting in a common control cabinet, stripped models in the working range of 30 inches of mercury vacuum to 100 P.S.I. pressure.
For differential sensing of .05 to 100 P.S.I.
For dual setting high and low limit protection.
For widely adjustable differential and high proof pressure.
Explosion-proof models for low pressure and vacuum sensing, single and dual setting.
Models with variable actuation value.
Barksdale
For heavy duty, single and dual setting up to 7000 P.S.I. proof pressures.
Models with external calibration dial.
Explosion-proof models for high pressures.
For use with highly corrosive media.
For accurate sensing of high pressures, single and dual setting.
For extremely long service life, high proof pressure settings from 35 to 12,000 P.S.I.
For sensing high differential pressures.

If you feel that the pressure switch for your application has to be tailor-made to your requirements, we can offer you the know-how, the experience and probably considerable savings in the bargain.

The know-how is available to you in the form of an engineering and production facility entirely specialized on the design and manufacture of pressure switches. Ask to see the 20-minute sound movie, "The Meletron Story."

The experience we can offer you has been put to the test in every conceivable type of industrial pressure switch application. Ask our representative in your area to show you applications resembling your own.

The savings you can make will be apparent when you consider that there are over six hundred pressure switches listed in our catalog. Even if you should require a special pressure switch, the major components are already in production. Ask for the latest pressure switch handbook and catalog.

PRESSURE SWITCH DIVISION

Barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIF.

THERE IS A BARKSDALE REPRESENTATIVE IN YOUR AREA:

Alabama, Birmingham	Missouri, Kansas City
Arizona, Phoenix	St. Louis
California, Los Angeles	Nebraska, Omaha
San Diego	New Jersey, Neptune
San Francisco	New York, Buffalo
Colorado, Denver	New York
Connecticut, Wethersfield	Rochester
Dist. of Columbia, Washington	Syracuse
Florida, Miami	North Carolina, Charlotte
Georgia, Atlanta	Ohio, Cincinnati
Illinois, Chicago	Cleveland
Rockford	Dayton
Indiana, Indianapolis	Oklahoma, Tulsa
Kansas, Wichita	Oregon, Portland
Kentucky, Louisville	Pennsylvania, Abington
Louisiana, New Orleans	Pittsburgh
Maryland, Baltimore	Tennessee, Memphis
Massachusetts, Newton	Texas, Houston
Michigan, Detroit	Washington, Mercer Island
Minnesota, Minneapolis	Wisconsin, Milwaukee

POWER PLANT & POWER SERVICES INDUSTRY

Putman Publishing Company

CREATORS OF

READER ACTION MAGAZINES

. . . featuring all these essential elements:

- TERSE VITAL EDITORIAL
- HAND-PICKED CIRCULATION
- "EXECUTIVE" FORMAT
- HIGH VISIBILITY
- QUALITY READERSHIP
- MORE READER ACTION

Circle 9438 opposite covers.